Operating Instructions

INTEGRAL XT

Process thermostats

XT 150, XT 250 W, XT 280, XT 280 W, XT 350 W, XT 350 HW, XT 490 W, XT 550, XT 550 W, XT 750, XT 750 S, XT 750 H, XT 750 HS, XT 950 W, XT 950 WS, XT 1590 W, XT 1590 WS, XT 1850 W, XT 1850 WS

High-temperature thermostats

XT 4 H, XT 4 HW, XT 8 H, XT 8 HW

Read the instructions before starting work!

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release 01/2015 g4 english
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Valid from:
software version of Command (Control Panel) 3.23
software version of Control system (Master) 2.42
software version of Security system (Master) 2.16
software version of Chilling system 3.29
software version of Pump 2.14
software version of Analogue IO module 3.10
software version of Serial IO module 3.11
software version of Digital IO module 3.11
software version of Ethernet module 1.14

LAUDA DR. R. WOBSER GMBH & CO. KG
Pfarrstraße 41/43
97922 Lauda-Koenigshofen
Germany

Phone: +49 (0)9343 503-0
Fax: +49 (0)9343 503-222
E-mail info@lauda.de
Internet http://www.lauda.de

Prefixed safety notes

Before operating the equipment please read carefully all the instructions and safety notes in Section 1.
If you have any questions please phone us!

Follow the instructions on setting up, operation etc. This is the only way to avoid incorrect operation of the equipment and to ensure full warranty protection.

- Transport the equipment with care!
  The unit may NEVER be overturned nor put upside down!
- Equipment and its internal parts can be damaged:
  - by dropping,
  - by shock.
- Equipment must only be operated by technically qualified personnel!
- Never operate the equipment without the heat transfer liquid!
- Do not start up the equipment if,
  - it is damaged or leaking,
  - cable (not only supply cable) is damaged.
- Switch off the equipment and pull out the mains plug:
  - for servicing or repair,
  - moving the equipment!
- Drain the device before moving the equipment!
- Do not carry out any technical changes on the device!
- Have the equipment serviced or repaired by properly qualified personnel only!

The Operating Instructions include additional safety notes which are identified by a triangle with an exclamation mark. Carefully read the instructions and follow them accurately! Disregarding the instructions may have serious consequences, such as damage to the equipment, damage to property or injury to personnel!

We reserve the right to make technical alterations!

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Explanation of signs:

Danger: This sign is used where there may be injury to personnel if a recommendation is not followed accurately or is disregarded.

\+ Note: Here special attention is drawn to some aspect. May include reference to danger.

þ Reference: Refers to other information in different sections.

1 Safety information

According to Paragraph 14 of the operational safety decree (BetrSichV)[1], the device is a system which requires supervision. (Classification according to the Pressure Equipment Directive 97/ 23 / EC: Category I). Before being put into operation, the system must be subjected to inspection for siting, for ascertaining that the device is in order and for correct functioning. A certificate must be issued regarding this inspection, documenting the extent and the result of the inspection.

[1]The national regulations of the respective country in which the system is sited must be followed.

1.1 General safety information

A process thermostat is used to heat, cool and circulate heat transfer liquids as specified. Hazards arise from this due to high or low temperatures, excess pressures, fire and the general hazards due to the application of electrical energy.
The user is largely protected by the application of the relevant standards.
Further hazard sources can arise from the type of material for which the temperature is to be stabilized, e.g. by the exceeding or undercutting certain temperature thresholds or by the fracture of the container and reaction with the heat transfer liquid.
It is not possible to include all possibilities. They remain essentially subject to the judgment and responsibility of the operator.
The devices may only be used as intended, that is as described in this operating manual. This includes operation by instructed specialist personnel.
The devices are not designed for use under medical conditions according to DIN EN 60601-1 or IEC 601-1.

Classes of the EMC standard DIN EN 61326-1:
Class A: Equipment for operation only on networks without connected domestic areas.
Class B: Equipment for operation on networks with connected domestic areas.

Valid for Europe:
The device is according to EMC (electromagnetic compatibility) requirements DIN EN 61326-1 see (þ 11).

\+ **Use restriction**
To EMC standard DIN EN 61326-1:
Class A devices must not be operated by power networks with connected domestic areas! (þ 11)

Valid for the USA:
Instructions for Class A digital devices
“This equipment has been tested and found to comply with the limits for Class A digital device, pursuant to Part 15 of the FCC (Federal Communication Commission) Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.”
“This device complies with Part 15 of the FCC (Federal Communication Commission) Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.”

Valid for Canada:
“This Class A digital apparatus complies with Canadian ICES-003” (ICES = Interference Causing Equipment Standards).
« Cet appareil numérique de la Classe A est conforme à la norme NMB-003 du Canada ».

1.2 Other safety information

- Check the device carefully for shipping damage before putting into operation. The device should not be put into operation if shipping damage has been found.
- Only connect equipment to PE grounded mains sockets.
- At higher operating temperatures, parts of the device (e.g. connection, drain points) can take on surface temperatures of over 70 °C. Be careful when touching the device à Danger of burns.
- After a mains failure or after switching off the device, the device surfaces can further heat up briefly.
- Use suitable hoses (þ 6.2).
- Check the hoses from time to time for any material fatigue. Hot liquid can escape due to hose fracture and become a danger to personnel and materials.
- Heat transfer hoses and other hot parts must not come into contact with the mains cable.
- The following actions may start the thermostat unintentionally from the standby mode: Previously activated timer mode (þ 7.14), "Start" command via interfaces (þ 8).
- Withdraw the mains plug before cleaning, servicing, repairing or moving the thermostat.
- Have repairs carried out only by specialists. The device may only be serviced by trained specialist personnel.
- Keep to service and maintenance intervals according to VDI 3033 (þ 9.2.6).
- Observe the permissible storage and operating temperatures (þ 11).
- The device should not be subjected to fire; otherwise there is the danger of an explosion.
- The device may only be operated with its housing in place.
- Do not site the device in areas where there are aggressive media.
- Only site the device on a level surface.
- Do not put any heavy parts on the device.
- The operating personnel must wear suitable protective equipment.
- Do not operate the device when leaks have been found; ventilate the siting room immediately.
- With pressure sensitive loads (e.g. glass apparatus) with a maximum permissible operating pressure below the maximum pressure of the pump (3.5 bars for water, with XT 1850 W 7.0 bars with water), the hoses of the load must be routed such that kinking or squashing is not possible. In addition, a separate safety valve must be installed to protect against faulty operation (þ 7.9.4, 7.9.5 and page 34).
- When selecting the heat transfer liquid, observe the permissible temperature range.

- Heat transfer liquids from LAUDA are recommended which have been tested for use with the device (þ 6.2).
- Always set the over temperature cut-off point immediately according to the heat transfer liquid used when filling (þ 7.16.1).
- If required, the heat transfer liquid should be checked for fitness for use (e.g. when changing the method of operation), or half-yearly. Further use of the heat transfer liquid is only permissible if the inspection indicates this (þ 9.3.1 and 9.3.4).
- Keep the cover of the filling point closed during operation.
- In certain operating conditions (degassing, fast heating up phases) the temperature in the expansion vessel can increase. In extreme circumstances the outflow temperature of the device is reached. If heat transfer liquids are operated above a certain temperature (25 °C below the flash point of the heat transfer liquid used), it is essential to prevent sources of ignition in the cover of the filling point.
- Degas carefully (slowly) (þ 7.6.3).
- It is essential to avoid gas cushions in the load system. This can be done by reducing the pump power by one or two levels and checking that the level indication of the device does not increase.
- If an overflow catchments container is connected, it must be suitable (including the connecting hose) for the maximum operating temperature. The connection hose must be securely fitted.
- The overflow must not be closed.
- Draining / drain mode is only permissible with an established temperature range (þ 7.7).
- During operation the drainage openings must be closed with plugs (standard accessories).
- On changing the heat transfer liquid, thoroughly clean the device and completely drain it. It is recommended that the device is rinsed with the new heat transfer liquid (þ 7.8).
- It is essential to prevent the ingress of secondary liquids (e.g. via a customer's defective heat exchanger).

Only water-cooled devices:

- The return hose of the water cooling must be securely fixed on the outlet port in order to prevent the hose sliding off uncontrollably, also during pressure surges.
- The return hose of the water cooling must be fixed on the outlet port that hot cooling water cannot splash out.
- It is essential to prevent kinking or squashing of the return hose for the water cooling. Excessive pressure can cause the cooling water hoses to tear and hot water to escape.
- To prevent damages by a leakage of the cooling water system it’s recommended to use a leak-water detector with shut-off valve (Aqua Stop).

2 Brief operating instructions

These brief instructions shall give you the possibility to operate the unit quickly.

For safe operation of the unit, it is absolutely necessary to read carefully all the instructions and safety notes!

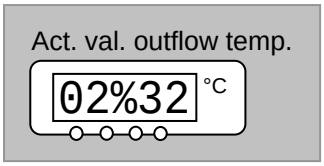
1. Set up the device or complete the configuration as required (þ 6.1).
   The device should never be tilted or stood upside down!
   Note the connection of the hose joints (þ 6.2).
2. Pay attention to pressure sensitive loads (e.g. glass apparatus) with a maximum permissible operating pressure (þ 7.9.4).
3. Only operate the Integral XT when flow through the external load is possible.
4. Open any shut-off valves in the external loads.
5. Compare the details on the rating label with the mains voltage.
   Three-phase device: Ensure a clockwise phase sequence.

   Only XT 1850 W Order No. LWP 732 and XT 1590 W Order No. LWP 742:
   Check the switch position [400 V; 3/PE; 50 Hz or 440-480 V; 3/PE; 60 Hz] for presence of mains voltage and frequency. An incorrect setting does not result in any damage, but an error message occurs `Error 367` (þ 9.4). With the unit switched off, set the incorrectly set switch to the correct voltage and frequency values. The switch is fitted on the back of the unit at the top left, behind the cover panel (þ 2.3).
6. Only connect device to a socket having a safety earth conductor.
7. Switch on the device by the main fuse-switch on the front panel ("ON = **I**").

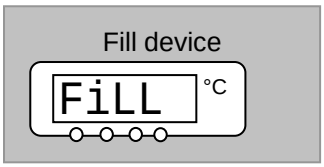
Bench-top device

Floor-standing device

8. In the display you see either the current outflow temperature , e.g.:



or if the device has not yet been filled:

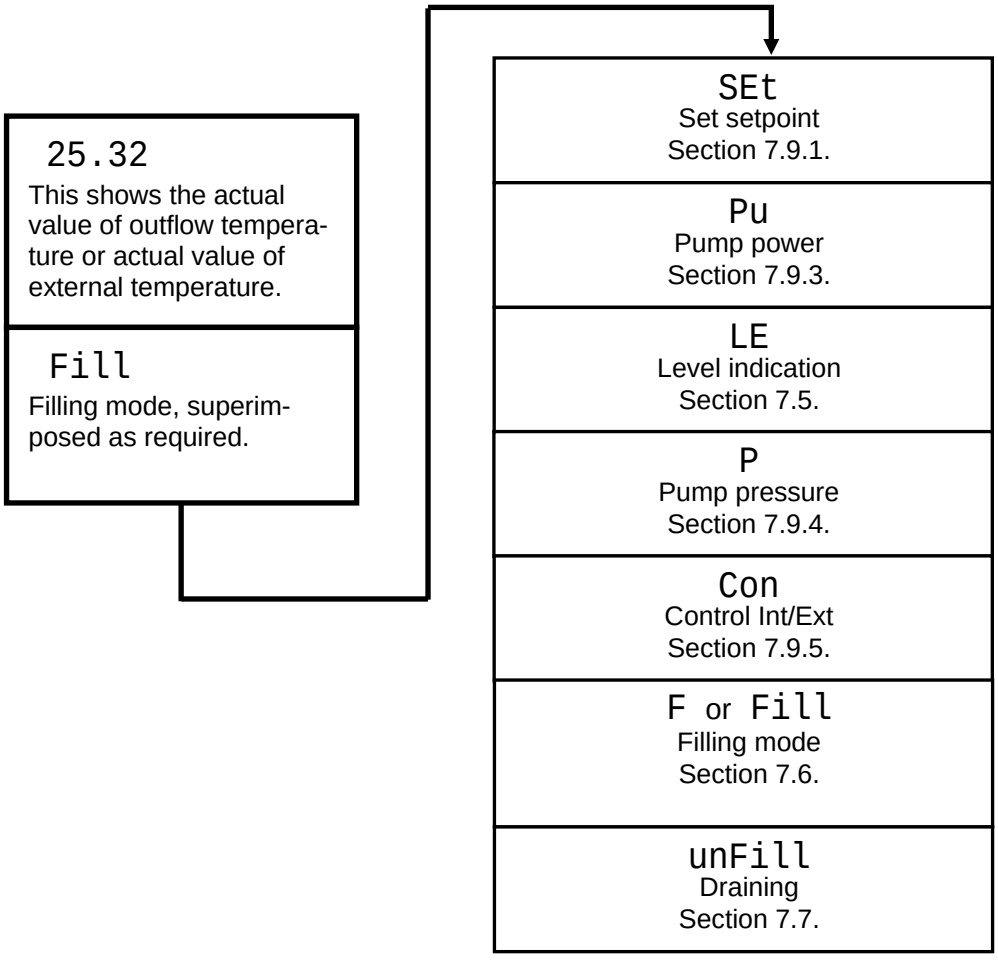


If instead, a warning or error message is displayed, then refer to Section 7.16.

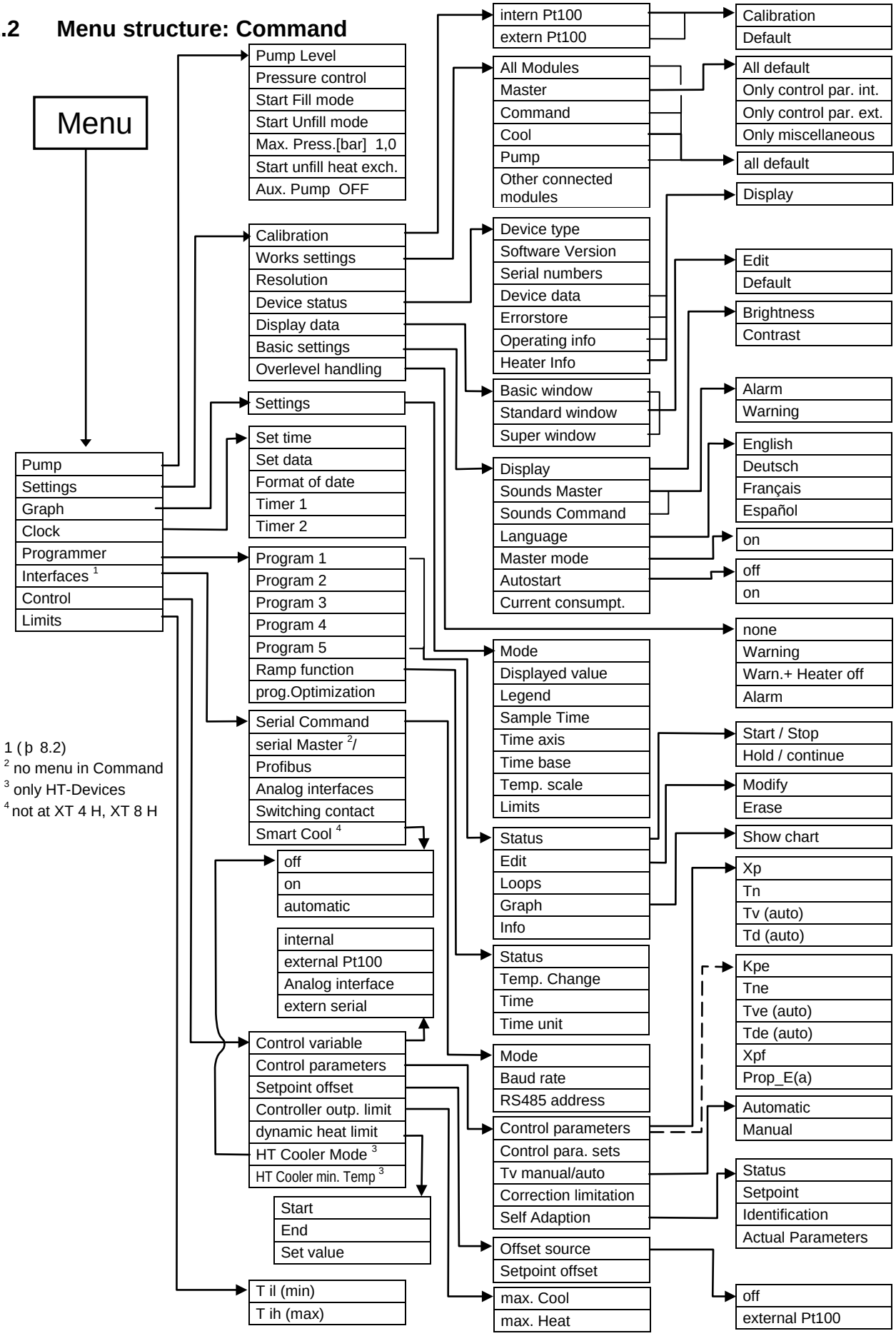
9. Fill device with heat transfer liquid and follow Section 7.6.
   Use suitable heat transfer liquid (þ 6.2).
   The devices are rated for operation with non-flammable and flammable liquids according to DIN EN 61010-2-010.
   Water is not permissible!!

10. Set the over temperature cut-off point with T_{max} according to the heat transfer liquid used (þ 7.16.1).

2.1 Menu structure: Master



2.2 Menu structure: Command



1 (þ 8.2)
2 no menu in Command
3 only HT-Devices
4 not at XT 4 H, XT 8 H

2.3 View of the device and connections

Integral XT 150

1 Main switch

2 Filling point for heat transfer liquid

3 Interface section

4 Mains cable

5 Drain point M16 x 1

6 Drain tap

Refer to page 19 for an illustrated side view of connections and taps.

Integral XT 250 W

Refer to page 19 for an illustrated side view of connections and taps.

Integral XT 350 HW and XT 950 W(S)

Refer to page 20 for an illustrated side view of connections and taps.

Integral XT 280, XT 750 (S) und XT 750 H(S)

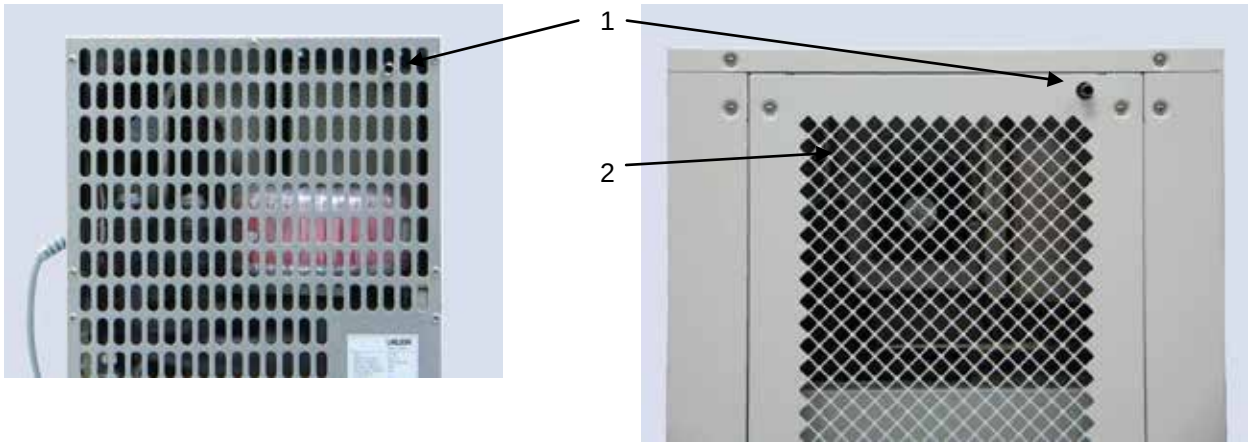
Refer to page 20 for an illustrated side view of connections and taps.

Integral XT 490 W, XT 1590 W, XT 1590 WS, XT 1850 W, XT 1850 WS

Refer to page 20 for an illustrated side view of connections and taps.

Rear view

XT 150/ XT 250 W **from XT 280**



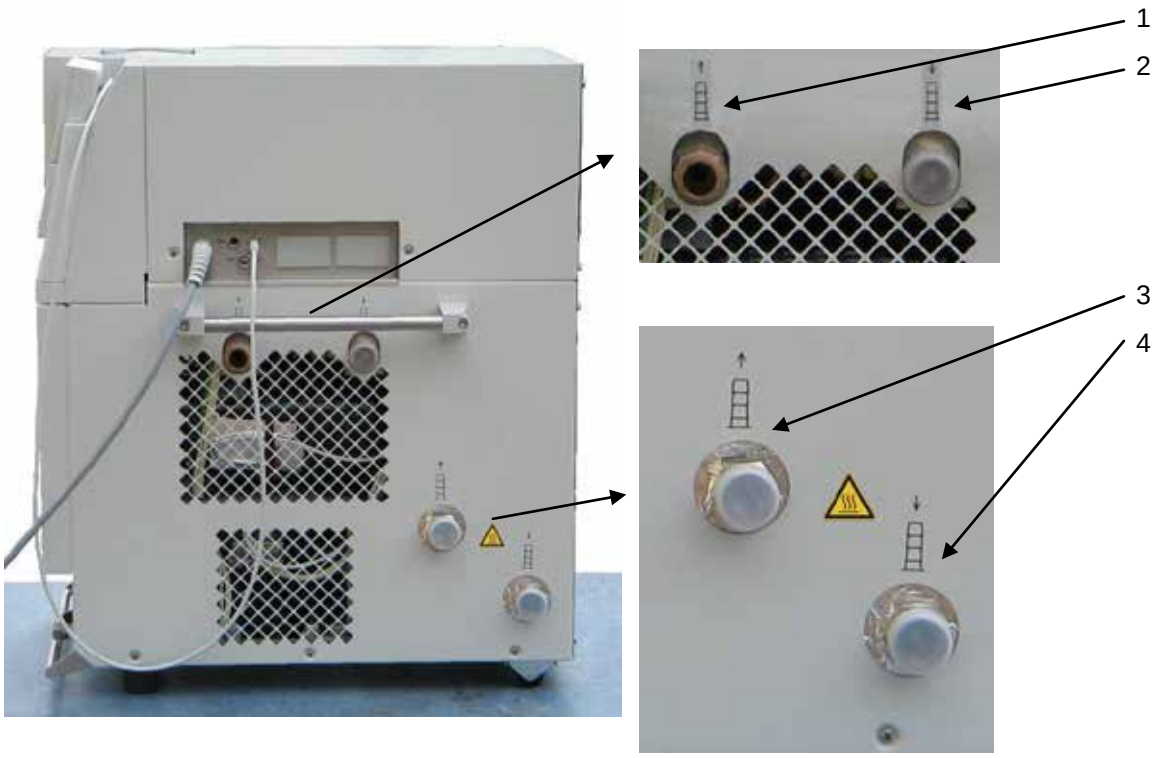
1 Overflow and venting for the equalizing container (all units)

2 Switch for setting mains voltage and frequency (þ 2 and 9.4) (only XT 1850 W Order No. LWP 732; XT 1590 W Order No. LWP 742).

Interface section

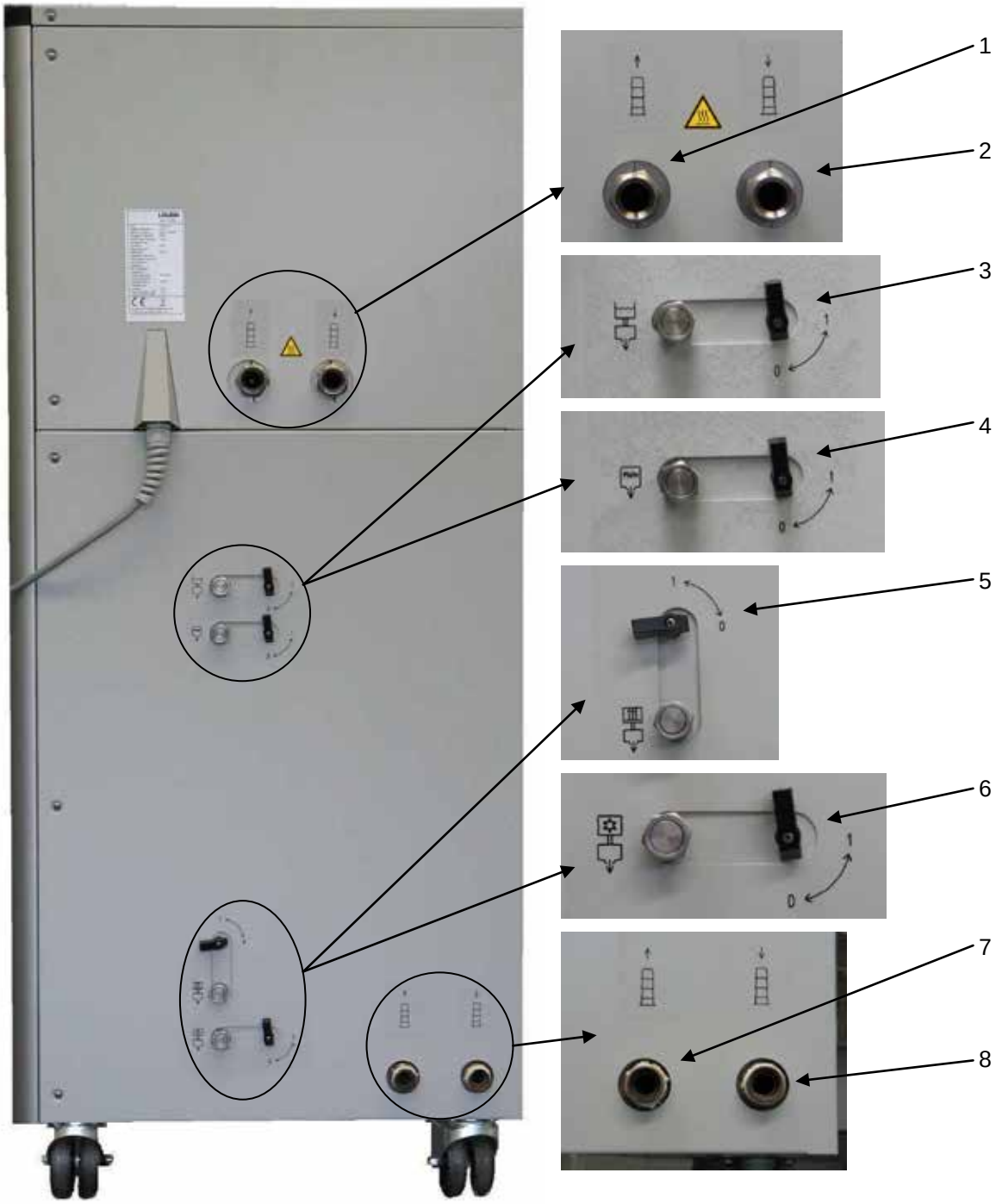
Two LiBus sockets for the Command remote control (standard) and LiBus accessories, socket for external Pt100 temperature probe (resistance thermometer to DIN EN 60751) (accessory), two slots for LiBus interface modules (accessories).

Side view of connections (with XT 250 W as example)



1 Exit cooling water connection R3/4” (only water cooled devices W).
2 Entrance cooling water connection R3/4” (only water cooled devices W).
3 Pump connector outflow M30 x 1.5 (to the consumer).
4 Pump connector return M30 x 1.5 (from the consumer).

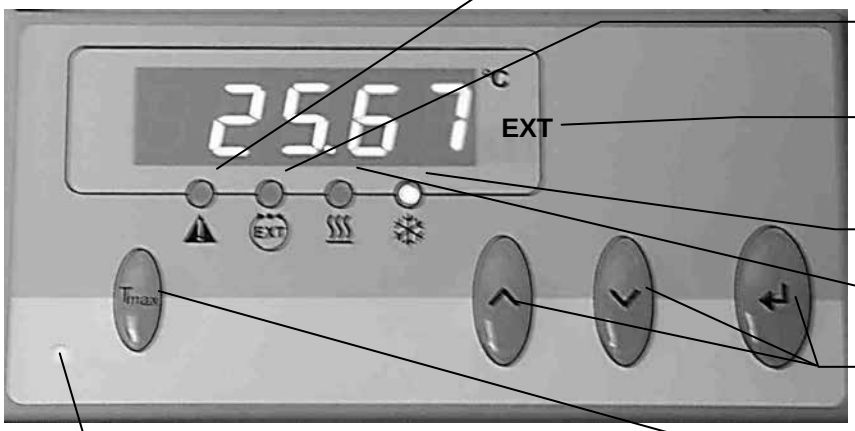
Side view of connections and taps (with XT 350 HW as example)



1 Pump connector outflow M30 x 1.5 (to the consumer) (XT 1850 W(S): M38 x 1.5).
2 Pump connector return M30 x 1.5 (from the consumer) (XT 1850 W(S): M38 x 1.5).
3 Drain point M16 x1 with drain tap: expansion vessel.
4 Drain point M16 x1 with drain tap: main emptying.
5 Drain point M16 x1 with drain tap: HT-cooler (only devices with temperature range up to 300 °C.)
6 Drain point M16 x1 with drain tap: cooling unit.
7 Exit cooling water, connection R3/4” (XT 1590 W(S), XT 1850 W(S): R1”) (only water cooled devices W)
8 Entrance cooling water, connection R3/4” (XT 1590 W(S), XT 1850 W(S): R1”) (only water cooled devices W)

3 Controls and functional elements

Control element: Master



Indication of an error message (red LED flashes)

Control with ext. temperature probe (green LED lights)

The temperature of the external source is shown in the display (EXT lights green)

Cooling active (blue LED lights)

Heating active (yellow LED lights)

Selection and entry keys

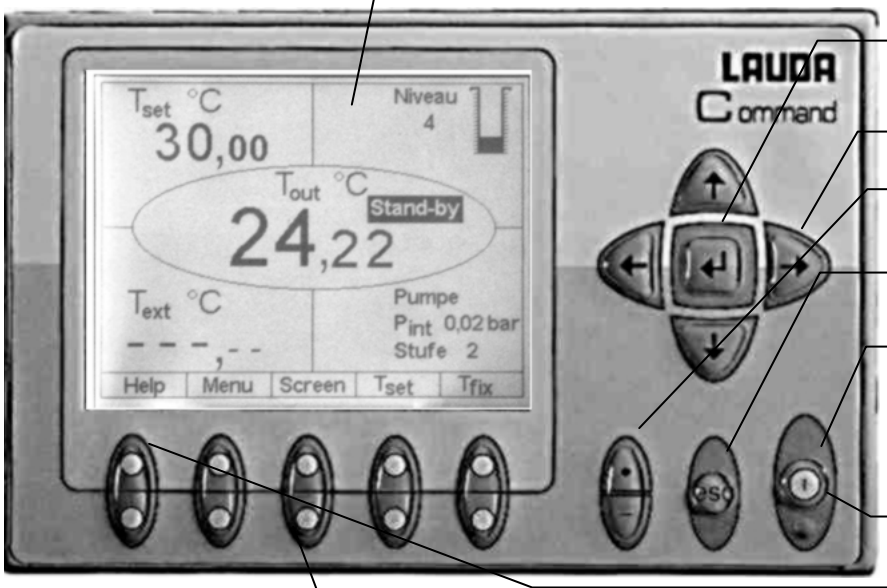
Overtemperature cut-off point
Check or set T_{max}

Mains on
(green LED)

Graphical display,
here in the normal window display of the values:

- Actual temperature T_{out} of the internal outflow temperature probe
- Setpoint temperature T_{set}
- Actual temperature T_{ext} of the external load temperature probe
- Level in the expansion vessel
- Pump level
- Outflow pressure

Control element:
Command remote control



Enter key

Cursor key

Decimal point or "-" sign

Escape key for quitting a window without making any changes

Standby key brings the thermostat into the waiting mode. Heating, refrigeration machine and pump are switched off.

Yellow standby LED

5 softkey duo-keys, the respective function of which is shown in the display

RS232 socket
(concealed on the back of Command)

4 Device description

4.1 Environmental conditions

The operation of the thermostats is only allowed under the following conditions as specified in EN 61010-2-010:2003 and EN 61010-1:2001:

- Indoor use.
- Altitude up to 2000 m above sea level.
- Foundation must be dense, even, non-slippery and non-flammable.
- Keep clear distance (þ 6.1).
- Ambient temperature range (þ 11).
  Use only within this range for an undisturbed operation.
- Mains supply voltage fluctuations (þ 11).
- Maximum relative humidity (þ 11).
- Transient over voltage according to Installation Categories (Over voltage Categories) II.
- Pollution degree: 2.

4.2 Types of devices

Process thermostats

The type designation of the Integral XT Process Thermostat consists of the numerical figures for the cooling power (in kW at 20 °C, mathematically rounded) and the minimum temperature (rounded, without arithmetical sign). The identifying letter "H" stands for devices with a maximum operating temperature of 300 °C or "W" stands for water-cooled variants.

Examples: XT 750 is a device with approx. 7 kW cooling power, approx. -50 °C lowest temperature and 220 °C highest temperature.
XT 350 HW is a device with approx. 3 kW cooling power, approx. -50 °C lowest temperature, 300 °C highest temperature and water cooling.

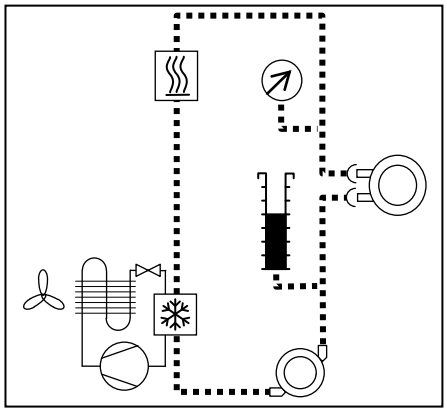
High-temperature thermostats

The type designation of the Integral XT High-temperature thermostat consists of the numerical figures for the heating power (in kW, starting from 230 V devices, mathematically rounded) and an identifying letter. The identifying letter "H" stands for high-temperature thermostats and "W" stands for water-cooled variants.
High-temperature thermostats with cooling water connection (type W) always require a cooling water supply, even if they are only used in heating mode.

Precise figures can be taken from the Technical Data (þ 11).

4.3 Hydraulic circuit and Vario pump

The hydraulic circuit in the unit partly consists of a pipe system through which the temperature stabilizing liquid flows under pressure.



The main components are:
pipe system,
equalizing tank (with no flow),
pump,
heater and
heat exchanger.

All devices are equipped with an eight-level, hermetically sealed (magnetically coupled) pump. The pump power can therefore be optimally matched to the respective task: High pump pressure when, for example, long hoses lead to external loads.

Alternative to eight power levels, operation with closed loop pressure control is available for supplying processes (loads) with a maximum permissible pressure rating e.g. pressure sensitive glass reactors.

On the right side of the device outflow and return connection pieces are fitted for external loads.

In the heating range the pump operates up to cinematic viscosities of 200°mm²/s. In normal operation 50°mm²/s should not be exceeded. From 30°mm²/s the temperature control is optimum.

The device pump connections are fitted with threaded connections M30 x 1.5 or M38 x 1.5 according to DIN 3863.

Pump characteristics (þ 11).

4.4 Substances / materials

All parts coming into contact with the media liquid are made of high quality material suitable for the operating temperature. Non-rusting stainless steel is used almost exclusively. To a slight extent brass/copper is used where the media temperature is 200 °C maximum. Sealing materials: Graphite, copper, PTFE, FKM, polymer seals.

4.5 Temperature display, control and safety circuit

The devices are fitted with a removable command operating console with back-lit graphical display which is used for displaying the measurements and setting values as well as the operating states. The entry of the set value and other settings occurs using menu guidance via context sensitive cursor and "soft" keys.

A Pt100 temperature probe measures the outflow temperature in the device. A high resolving A/D converter processes the measurement. Further measurement processing occurs via a special control algorithm for driving the heating power actuator and the special cooling system with further measurement transducers.

An external Pt100 can be connected via a socket (10S) for measuring an external temperature. This value can be displayed and if required, used as the controlled variable when the external controller (master) is switched on. In this way the system control is based on the external measurement and not on the outflow temperature.

The safety system conforms to DIN EN 61010-2-010. A dual-channel system is used in which two micro-controllers monitor one another. Apart from the outflow temperature or temperature probe, there is a second safety temperature probe (Pt100) for the safety circuit for switching off due to excessive temperature and for monitoring the outflow temperature probe. This fulfills the requirements of DIN EN 61010-2-010. The over temperature switch-off point is displayed by pressing the key

on the Master.

Changing the over temperature cut-off point: (þ 7.16.1).

The level in the expansion vessel is acquired by the SelfCheck Assistant in 15 levels. If the minimum level is undercut, the pump, heating and refrigerating machine are switched off. The behavior in the case of an excessive level can be set (þ 7.16). Different reactions can be chosen depending on the thermostatic medium.

With low level, over temperature or other alarms the SelfCheck Assistant switches the heater off on all poles. The pump and the refrigerating machine are also switched off.

This fault switch-off remains, i.e. once the fault has been rectified the alarm must be released with the reset key .

Other device functions are described in the corresponding sections and in Section 7 (Starting up).

4.6 Programmer and ramp function

The units are equipped with a programmer function which enables five temperature/time programs to be saved. Each program consists of a number of temperature/time segments. These also include details of how often the program is to be executed. Up to 150 segments can be distributed amongst the five programs (þ 7.12).

With the ramp function a rate of change can be directly entered in °C/unit time.

4.7 Interfaces

As standard, the device is fitted with the following sockets:

- one socket 10S, for an external Pt100 temperature sensor.
- two sockets 70S, for the Command remote control and for LiBus Components.
- an RS232/RS485 interface (65S) at the back of the Command remote control.

4.8 Interface modules (accessories)

Other interface modules can be inserted into two slots (refer to Section 8).
The following modules are currently available:

1. **RS232/485 Interface Module** (Order No. LRZ 913) with 9-pole SUB-D socket. Electrically isolated through optocouplers. Command set largely compatible with the ECO, Ecoline, Proline, Integral XT and Integral T Series. The RS2323 interface can be directly connected to the PC with a cable wired 1:1 straight through (Order No. EKS 037).
   Further details can be found in section 7.17 and 8.3.
2. **Analog Module** (Order No. LRZ 912) with two inputs and two outputs on 6-pole DIN socket. The inputs and outputs can be set independently as 4...20 mA, 0...20 mA or 0...10 V interface.
   Further details can be found in section 8.4.
3. **Contact Module** (Order No. LRZ 915) on 15-pole SUB-D socket. With three relay contact outputs (changeover, max. 30V/ 0.2A) and three binary inputs for control via external voltage-free contacts. Plug 15-pole, Order No. EQM 030 and plug case Order No. EQG 017.
   Further details can be found in section 8.5.1.
4. **Contact Module** (Order No. LRZ 914) with connector to NAMUR NE28. Functionality as LRZ 915, but only one output and one input on each of two DIN sockets. Coupling socket 3-pole, LAUDA Order No. EQD 047 and coupling plug 3-pole, LAUDA Order No. EQS 048.
   Further details can be found in section 8.5.2.
5. **Profibus** (LAUDA Order No. LRZ 917).
   Further details can be found in the operating instructions YAAE0020 of the Profibus Modules.

4.9 Refrigerating unit

The refrigerating machine mainly consists of one or two fully hermetically sealed compressors. The dissipation of the condensation and motor heat takes place via a fan-ventilated laminated condenser. Here, fresh air is drawn in at the front of the unit, heated towards the back and output at the side. To ensure proper air circulation the ventilation slots must not be restricted. (þ 6.1).
The condenser must be cleaned regularly to prevent soiling (þ 9.3.2.1). The SelfCheck Assistant outputs a warning signal when the condenser is soiled.

On water cooled devices the heat dissipation takes place via a plate-type heat exchanger or a bundle tubing heat exchanger using cooling water. Regular cleaning is also required here depending on the water contamination
(þ 9.3.2.2).

The compressors are equipped with over temperature cutouts which respond to the compressor temperature and the compressor current consumption. In addition the refrigerating system is backed up by a pressure control device against over pressure. The refrigerating unit is normally switched in automatically, but can be switched manually via the operating menu (þ 2.2).

When the fault circuit trips, the refrigerating unit is also switched off.

5 Unpacking

+	- If the device is overthrown or overturned on the shipping, log the fall and contact also the LAUDA Service Constant Temperature Equipment. (þ 9.5) - To repack the unit carefully and properly, it is necessary to store the original package!

5.1 After unpacking

After unpacking, firstly check the device and accessories for any damage in transit. If contrary to expectations the unit is found to be damaged, the shipping company must be immediately informed so that verification can take place.
Please also inform the LAUDA Service Constant Temperature Equipment (Contact þ 9.5).

5.2 Standard accessories:

Quantity	Article		Article no.
1 x	Operating Instructions	for all devices	YAWE0028
each 1 x	Plug and union nut (for M16 x 1)	for bench-top devices	HKN 065 HKM 032
each 3 x	Plug and union nut (for M16 x 1)	for floor-standing devices	HKN 065 HKM 032
each 4 x	Plug and union nut (for M16 x 1)	for floor-standing devices with high temperature cooler (H)	HKN 065 HKM 032
2 x	Threaded hose coupling Nipple ½"; Nut R¾"	for all water-cooled devices (W) except XT 1590 W(S) and XT 1850 W(S)	EOA 001
2 x	Threaded hose coupling Nipple ¾"; Nut R1"	XT 1850 W(S), XT 1850 W(S)	EOA 053
2 x	Screw cap M30 x 1.5 (plastic)	XT 150, ..., XT 1590 W(S)	EZV 101
2 x	Screw cap M38 x 1.5 (plastic)	XT 1850 W, XT 1850 WS	EZV 129

5.3 Unpacking and packing with original transport packaging material

5.3.1 Sector of application

From Integral XT 280 up to and including XT 1850 WS. There are two different sizes of transport palettes, one for middle chassis (XT 280 / 350 / 550 / 750 / 950) and one for big (XT 490 / 1590 / 1850) chassis.

5.3.2 Background

For the customer to allow a properly packaging, e.g. for further transport or return transport to LAUDA.

5.3.3 Supposition

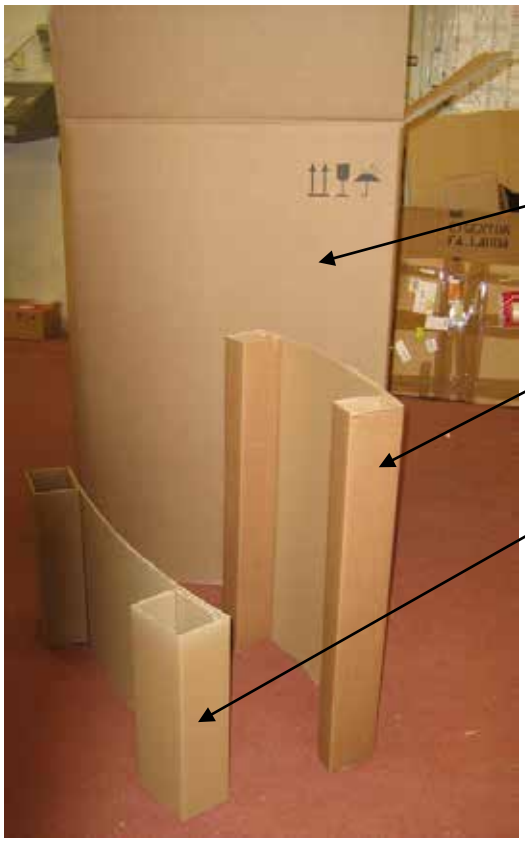
You need a crane with two textile slings or lashings; or a fork lifter with adjustable fork.

5.3.4 Unpacking the device

To unpack the device with crane or fork lifter see the order “Packing and unpacking order Integral XT”. Art. No. YVW 0001.

5.3.5 Packing for shipping with original transport packaging material

5.3.5.1 Overview

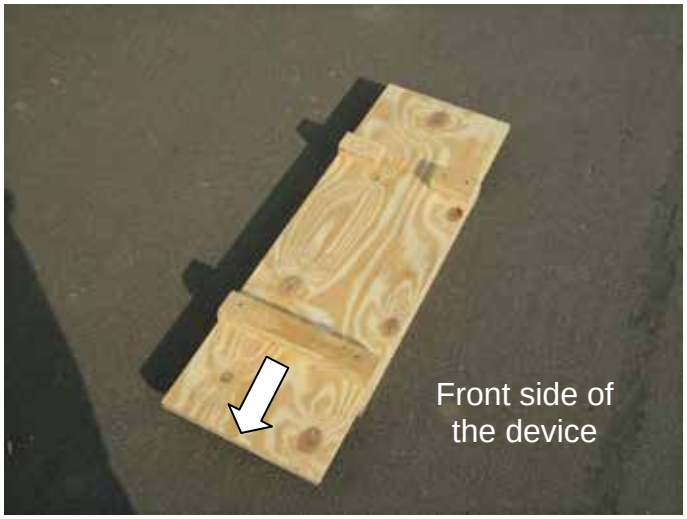


Cardboard box

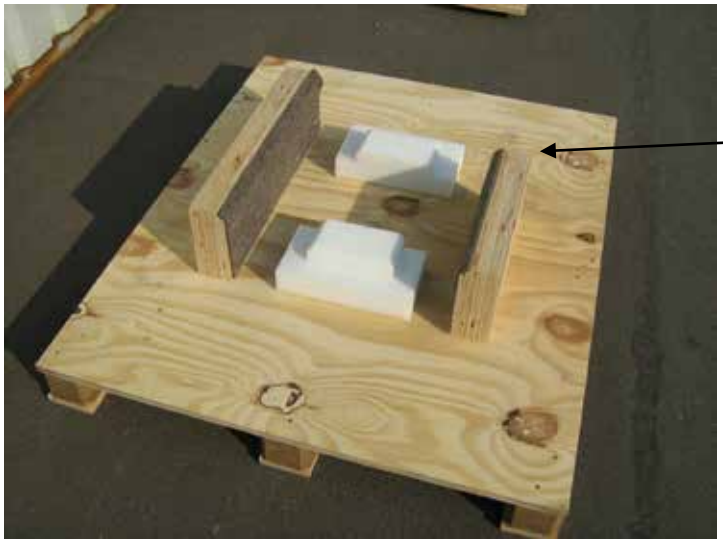
Outer cardboard box

Large distance cardboard

Small distance cardboard

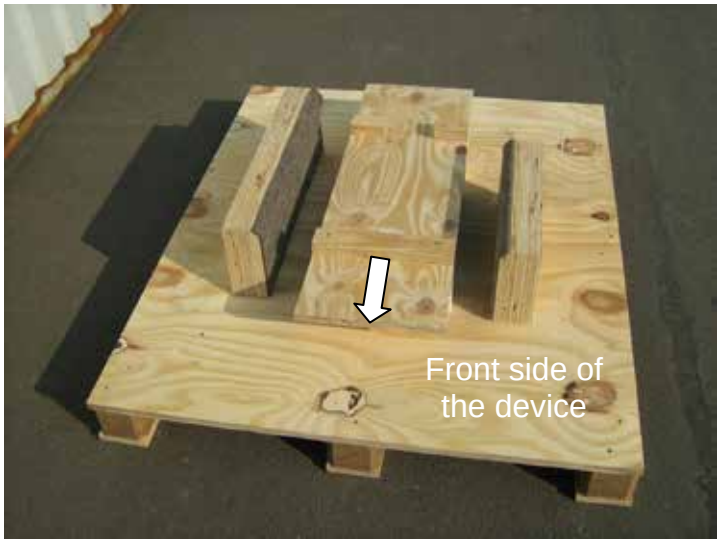


Transportation board



Pallet

Recess on the pallet for the cooling water in and out connections.



Pallet with transportation board in place.

5.3.5.2 Packing the device

Align the wheels on the device length.

Move transportation board underneath. The longer part of the board with end-to-end bar to the front side of the XT unit.

Place transportation strips under both sides of the transportation board. Do not use chains!

Lift the XT unit up and move it over the pallet. Take care for good position between the fixtures of the pallet and take care for the cooling water connections.

Recess on the pallet is giving space for the cooling water connections.

Slip over the outer cardboard box. It is fixed by transportation board and pallet.

Place the operating instructions of Integral XT device on top of the device.

First bring in the small distance cardboard (þ 5.3.5.1). The two beads shall be on the front and rear side of the unit.

Then place the large distance cardboard 90° rotated to the small distance cardboard.

Close the outer cardboard box with retaining clips and adhesive tape.

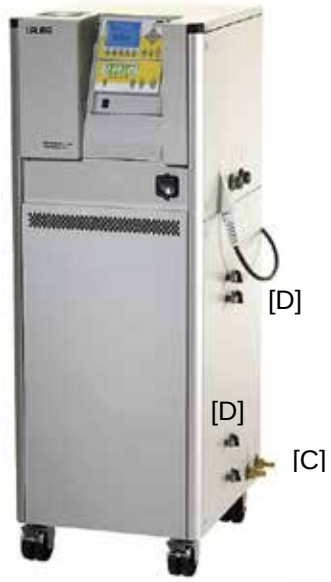
Secure the outer cardboard box twice on its larger and once on its smaller side.

Stick on labels, markings and shock sensors!

This unpacking instruction has to be placed prominent in a transparent plastic bag.

6 Preparations

6.1 Assembly and siting



- Site the unit on a flat surface.
- The unit must not be put into operation if its temperature during storage or transport has dropped below the dew point. Wait for about one hour.
- The device should **never** be tilted or stood upside down.
- Do not cover the ventilation openings.
- Leave free space on all sides (þ 11).
- Plug the bus connector of the Command remote control into the 70S socket and secure it. Further T-adaptors are available as accessories EKS 073.
- Check that the **drain tap [D]** is closed (position 0), and that the sealing cap on the drain is fully tightened. Tighten the sealing cap only slightly with the open-ended wrench (AF 19). (There are one to four drain taps depending on the device).
- Check that with water-cooled (optional) devices the **cooling water inlet** and the **cooling water outlet [C]** are correct and firmly connected.

Watercooled High-temperature thermostats:
Always connect cooling water

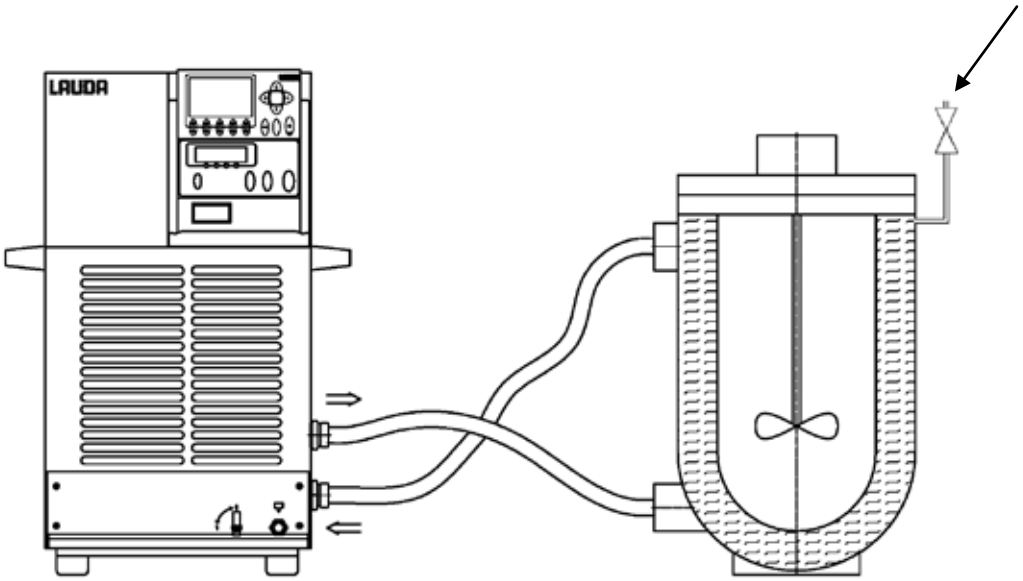
Cooling water connection is not established
Equipment damage (lasting damage to the high temperature valve)
· The High-temperature thermostat has to be connected to the cooling water supply!

Connection of the load

+

- Connection of closed loads only!
- In order that gas and vapor bubbles can be driven out of the system and undisturbed operation is possible, the external load must be connected according to the sketch. The outflow is connected to the external load point located at the bottom and the return line must be connected to the external load point located at the top so that liquid passes through the load from the bottom to the top.

Vent valve Entlüftungsventil



Fitting instructions for the connections to the load

Ball-type nipples and olives:

- The sealing surfaces of tapers and ball-type nipples/ olives must not be damaged (dropping on hard floors etc.).
- Contamination on the sealing surfaces (taper and ball-type nipple/ olive) must be carefully removed before fitting.
- Place the ball-type nipple/ olive vertically onto the cone (support the hose, etc. when tightening).
- The ball-type nipple/ olive must not turn when tightening the union nut (if necessary, apply a little grease or oil between the ball-type nipple/ olive and the union nut.
- Tighten the union nut only slightly with an open-ended wrench and counter with a second wrench on the connection nozzle.

Olives:

- Push a hose onto the hose olive. Secure hoses against slippage with the aid of hose clips etc.

General notes:

- Always ensure the largest possible passages in the external circuit. For a hose cross-section that is too small à Temperature gradients occur between the device and external load due to low volume flow.
- Only operate the Integral XT when flow through the external load is possible.
- Open any shut-off valves in the external loads.
- Depending on the configuration of the load circuit, a venting valve can significantly simplify the venting process. The venting valve should be positioned at the highest point of the hydraulic circuit (þ see also the drawing on page 34).
- Reactors for steam heating are not suitable as external loads, because they generally have an area through which flow does not pass and in which vapor cushions can form.
- If external control is to be used, provide a Pt100 probe in the external load.

- Pay attention to pressure sensitive loads (e.g. glass apparatus) with a maximum permissible operating pressure (þ 7.9.4).
- Check whether the hoses for external loads have been mounted.
- With outflow temperatures over 70 °C the supplied self-adhesive label (EZB 260) should be applied on the device at an easily visible point.
- Do **not** carry out technical changes on the device!

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- The unit can be safely operated up to an ambient temperature of 40 °C.
- An increased ambient temperature (above the reference temperature of 20 °C) reduces the cooling capacity and the minimum temperature that can be achieved.
- With loads situated at a higher level and with the pump stopped and air seeping into the thermostatic circuit (for example a not completely closed or defective venting valve), then even with enclosed circuits, the external volume can run empty.
  à Danger that the process thermostat will overflow!
- Install a dirt trap if the complete heat transfer system on the customer side is not guaranteed to be dirt free.

Connection of the cooling water

Note that the following conditions apply for the connection of the cooling water supply:

Cooling water pressure (feed - outlet)	maximum 10 bar overpressure
Differential pressure (feed - outlet)	minimum 3.0 bar
Cooling water temperature	10 to 15 °C recommended, 10 to 30 °C admissible (with power restrictions)
Cooling water quantity	see Technical Data (þ 11)
Cooling water hose for connection to the device	minimum 13 mm (up to XT 950 W) minimum 19 mm (XT 1590 W(S), XT 1850 W(S))

6.2 Heat transfer liquids, cooling water and hoses

Filling, venting and degassing of heat transfer liquids (þ 7.6).

Testing of the heat transfer liquid (þ 9.3.4).

a) Approved heat transfer liquids

LAUDA designation	Tempera-ture range	Chem. designation	Viscosity (kin)	Viscosity(kin) at temperature	Fire point	Packing drum Order number		
	from °C to °C		mm²/s at 20 °C	mm²/s	°C	5 L	10 L	20 L
Ultra 350	30...350	Synthetic heat transfer liquid	47	28 at 30 °C	> 240	LZB 107	LZB 207	LZB 307
Kryo 30 À	-30...90	Monoeth-ylene glycol/ water	4	35 at -20 °C	--	LZB 109	LZB 209	LZB 309
Kryo 70	-70...220	Silicone oil	5	43 at -60 °C	> 162	LZB 127	LZB 227	LZB 327
Kryo 90	-90...140	Silicone oil	1.76	15 at -70 °C	/ 56	LZB 128	LZB 228	LZB 328

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À The proportion of water reduces with longer working at high temperatures à Mixture becomes flammable (flash point 128 °C). à Check the mixing ratio using a hydrometer.

- When choosing the heat transfer liquid it must be noted that at the lower limit of the temperature range a worsening of the properties is to be expected due to the increasing viscosity. Therefore only fully exploit temperature ranges when required.
- The working ranges of the heat transfer liquids and hoses are general figures which can be tightened due to the operating temperature range of the devices.

- With silicone rubber, silicone oils lead to substantial swelling. à Never use silicone oil with silicone hoses.
- EPDM hose is <u>not</u> suitable for Ultra 350 and <u>not</u> suitable for mineral oils.

Safety data sheets for heat transfer liquids can be ordered if required.

b) Cooling water

Certain requirements are placed on the cooling water with regard to purity. Depending on the cooling water contamination, a suitable method of purification and/or treatment of the water must be employed. The condenser and the complete cooling water circuit can become blocked, damaged and leaky due to unsuitable cooling water. Extensive consequential damage may arise on the whole cooling circuit. The cooling water quality depends on local conditions. If a fault or damage occurs due to unsuitable water quality, it is not covered by our guarantee.

Important: Danger of corrosion of the cooling water circuit due to water of unsuitable quality.

- Free chlorine (e.g. from disinfectants) and water containing chlorine lead to pitting in the cooling water circuit.
- Distilled, deionized or demineralized water is unsuitable due to its corrosive properties and leads to corrosion in the cooling water circuit.
- Seawater is unsuitable due to its corrosive properties and leads to corrosion in the cooling water circuit.
- Water containing iron or iron particles leads to rust formation in the cooling water circuit.
- Due to the high lime content hard water is not suitable for cooling and leads to calcification in the cooling water circuit.
- Cooling water with suspended matter is not suitable.
- Untreated and unpurified river or cooling tower water is not suitable due to its microbiological content (bacteria), which can become deposited in the cooling water circuit.
- Putrid water is not suitable.

Suitable cooling water quality

pH – value	7.5 – 9.0
Sulfates [SO_4^{2-}]	< 70 mg/L
Hydrocarbonates [HCO_3-]/ sulfates [SO_4^{2-}]	> 1.0
Total hardness	4.0 – 8.5 °dH
Hydrocarbonates [HCO_3-]	70 – 300 mg/L
Conductivity	10 - 500 µs/cm
Chlorides (Cl^-)	< 50 mg/L
Sulfites [SO_3^{2-}]	< 1 mg/L
Free chlorine gas (Cl_2)	< 1 mg/L
Nitrates (NO_3 -)	< 100 mg/L
Ammonia (NH_3)	< 2 mg/L
Iron (Fe), dissolved	< 0.2 mg/L
Manganese (Mn), dissolved	< 0.1 mg/L
Aluminum (Al), dissolved	< 0.2 mg/L
Free aggressive carbonic acid (CO_2)	< 5 mg/L
Hydrogen sulfide (H_2S)	< 0.05 mg/L
Algae growth	Not permissible
Suspended matter	Not permissible

Risk to the environment due to oil contamination of the cooling water circuit

With a leaky condenser there is the danger that refrigerating machine oil from the coolant circuit of the cooling thermostat can pass into the cooling water.
Follow all the legal requirements and the regulations of the water supply utility which apply at the point of use.

Water pollution due to leakage

To avoid pollution due to a leak in the cooling water system it is recommended that a leakage-water detector with a water cut-off is installed.

Servicing intervals

Follow the information for cleaning and decalcifying the cooling water circuit (þ 9.3.2.2).

c) Hoses

Metal hoses in non-rusting stainless steel with union nut M30 x 1.5 internal width 20 mm

Hose type	Length (cm)	Temperature range °C	Field of application	Order number
MXC 100S	100	-50...300	With special insulation for cold and hot areas for all heat transfer liquids	**LZM 081**
MXC 200S	200	-50...300	"	**LZM 082**
MXC 300S	300	-50...300	"	**LZM 083**

Metal hoses in non-rusting stainless steel with union nut M38 x 1.5 internal width 25 mm

MX2C 100S	100	-50...300	"	**LZM 084**
MX2C 200S	200	-50...300	"	**LZM 085**
MX2C 300S	300	-50...300	"	**LZM 086**

Torque specifications for the assembling

The threads of the pump connectors or the threads of the union nuts and the seat of the mother must be moistened with a lubricating medium.

Catalogue number and type designation	Maximum torque specification	Thread	Maximum permitted pressure
LZM 081 / MXC 100S	70 Nm	M30 x 1.5	max. 10 bar
LZM 082 / MXC 200S	70 Nm	M30 x 1.5	max. 10 bar
LZM 083 / MXC 300S	70 Nm	M30 x 1.5	max. 10 bar

Note:

When using metal hoses M16 x 1 with reduction (from M30 x 1.5 to M16 x 1), the following maximum permitted pressures are valid, depending on the temperature
(Hoses LZM 040 - 049, LZM 052 - 055, LZM 069).

Temperature range	Maximum permitted pressure
up to 20 °C	2.3 bar
up to 100 °C	1.9 bar
up to 300 °C	1.5 bar

.

7 Starting up

7.1 Mains connection

Compare the rating on the name-plate (þ 9.5) with the mains voltage.

Only valid for the USA:
Instructions for Class A digital devices
“This equipment has been tested and found to comply with the limits for Class A digital device, pursuant to Part 15 of the FCC (Federal Communication Commission) Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.”
“This device complies with Part 15 of the FCC (Federal Communication Commission) Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.”

Only valid for Canada:
“This Class A digital apparatus complies with Canadian ICES-003” (ICES = Interference Causing Equipment Standards).
« Cet appareil numérique de la Classe A est conforme à la norme NMB-003 du Canada ».

- Connect unit only to sockets with a protective earth conductor (PE). No liability is accepted for incorrect mains connections!
- Ensure that the unit is filled according to Section 6.2 and 7.6.

Three-phase device:

Ensure a clockwise phase sequence. If the device is connected with the wrong direction of rotation, an alarm signal is output.

7.2 Switching on

+ High-temperature thermostats with cooling water connection (type W) always require a cooling water supply, even if they are only used in heating mode.

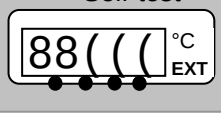
Failure of the cooling water supply
Equipment damage (lasting damage to the high temperature valve)
· Note the beeps, warnings and alarms of the device! (þ 9.4)

Switch on the main switch on the front panel:

☼

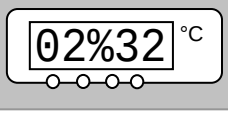
- The green LED for "Mains ON" is lit,

Self-test



- and the unit starts its self-test. All display segments and symbols appear for about 1 s.

Act. val. outflow temp.

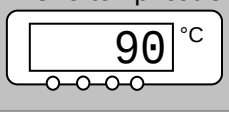


- Display of the current outflow temperature ,
- The pump starts provided "Standby" or "Manual start" (þ Section 7.10.2) has not been programmed,
- all values are accepted which were active before switch-off.

Fill mode

- If the device has not been filled, this display appears. Then continue with Section 7.6 Filling, venting and degassing.

Overtemp. cut-off.



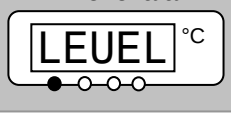
Check or set over temperature cut-off point:

- The switching point is shown in the LED display on pressing the key

.
- Change over temperature cut-off (þ 7.16.1).
- Top up with heat transfer liquid as required which is pumped out due to filling up the external load.

\+

Level alarm

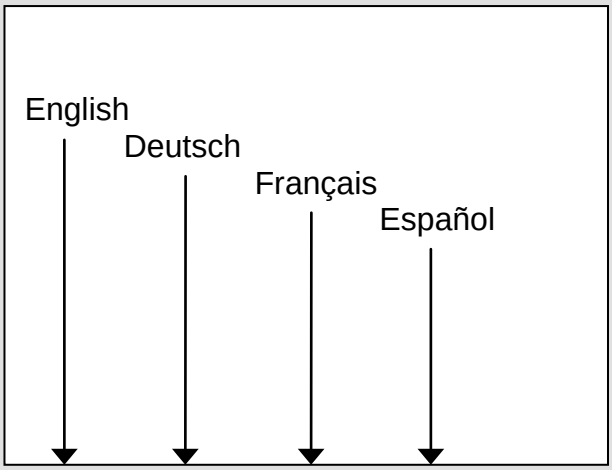


- Display for LEUEL (low level) appears when the expansion vessel has too little liquid.
- Red LED ☼ above the fault triangle ⚠ flashes.

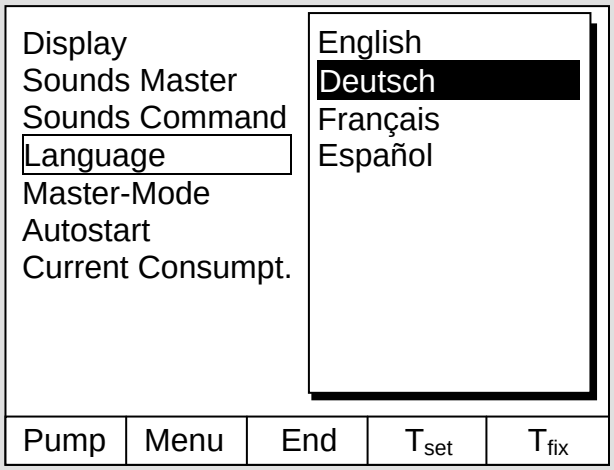
☼ ⚠

- Find cause of fault (þ 9.4) and, where necessary, top up missing liquid (þ 6.2).
- Press the Enter key.
- Also press the key if unit has been switched off in the fault state.
- No release is possible on Command remote control!

Command Language



- If the Command remote control is being switched on for the first time, the illustrated window appears automatically, enabling you to select the dialog language with the appropriate soft key.



- The dialog language also can be changed later via à Settings à Basic settings à Language.
- Mark the required language with or .
- Confirm the selection with .

7.3 Switching off / standby

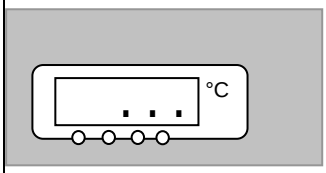
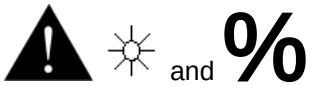
Switching off: Set mains switch to position 0.

Standby operation: Use the key on the Command remote control. The pump, heating and cooling unit are switched off.
The operating display remains active, so that the device status is visible and adjustments can be made.

The timer continues to run. Stop as required with Pause (þ 7.14).

7.4 Key functions

7.4.1 General key functions and pilot lamps

Master	
	Enter key: - From the actual-value display at the main menu level, - activates input, display flashes, - saves input, display ceases to flash and menu point is left, - press for approx. 3 s: Exit function and return to outflow temperature display.
or	- Paging with keys is possible within the relevant level, or setting of numerical values. Speeds up entry by moving the counting position to the left: a) Keys are pressed and held down **or** b) one of the two keys is pressed and held down, followed immediately by brief pressing of the other key. Moves counting position to the right: - Switching one **place to the right** occurs by briefly (1 s) releasing the key, followed by another pressing of the key.
	Useful additional information: - 2 dots in the Master display indicate that a submenu follows. - 3 dots in the display indicate that a submenu for a module (interface...) or a component (thermostat, Command remote control ....) follows. Module/component-specific possible settings are only displayed when the hardware is connected.
	- **The following always applies:** After termination of the relevant settings, they are accepted automatically after approx. 4 s **or** - the setting is accepted immediately with the Enter key.
	- Fault signal. Flashing red Alarm LED and acoustic signal. - An acoustic signal can only sound when it has not been intentionally deactivated! (þ 7.10.5).
	- The control occurs via the external temperature probe when the green LED is lit.
	- Heating is active when the yellow LED is lit.
	- Cooling is active. When the setpoint temperature is lowered, it may take up to one minute before the blue LED is lit.
EXT	- The temperature of the external probe is displayed.

Command

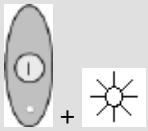
- Enter key ("Confirm selection") and go back one level.

End

- Soft key function to confirm a selection or input and to return to the main display window.

- Escape key to quit a window without changes and to go back one level.

- Cursor keys for Up, Down, Left and Right.

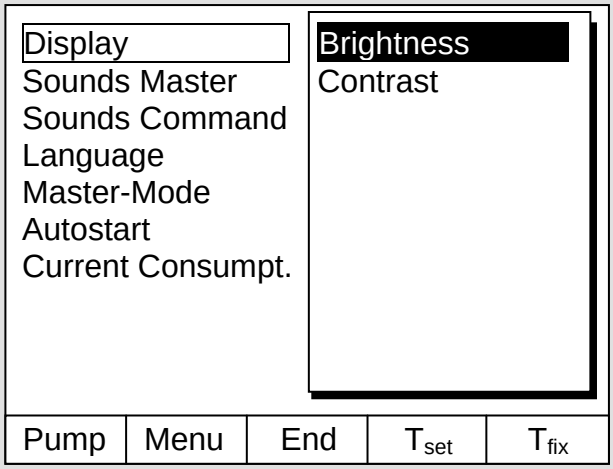


- Standby activation (pump, heater and refrigerating machine are deactivated when the yellow LED is lit).
  But timer continues to run. Refer to safety information in (þ 7.9.3).

Duo key:

- Top: Decimal-point key,
- Bottom: Key for arithmetic sign.

- Soft keys: 5 duo-keys which each have the function shown in the display above them. Soft-key entries are shown framed in the operating instructions. Example: You would like to change the setpoint temperature, then press the duo-key under T_{set}.



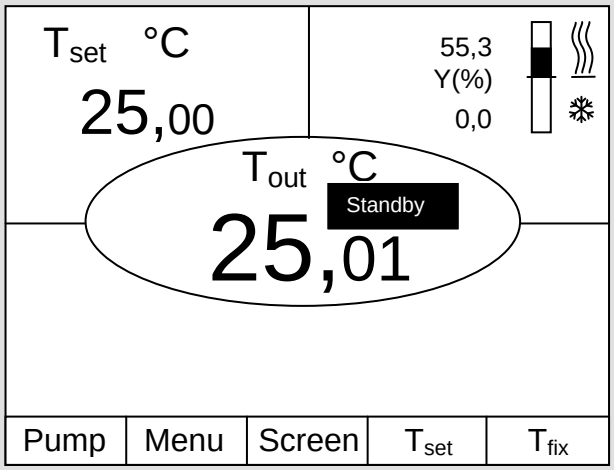
Brightness Contrast

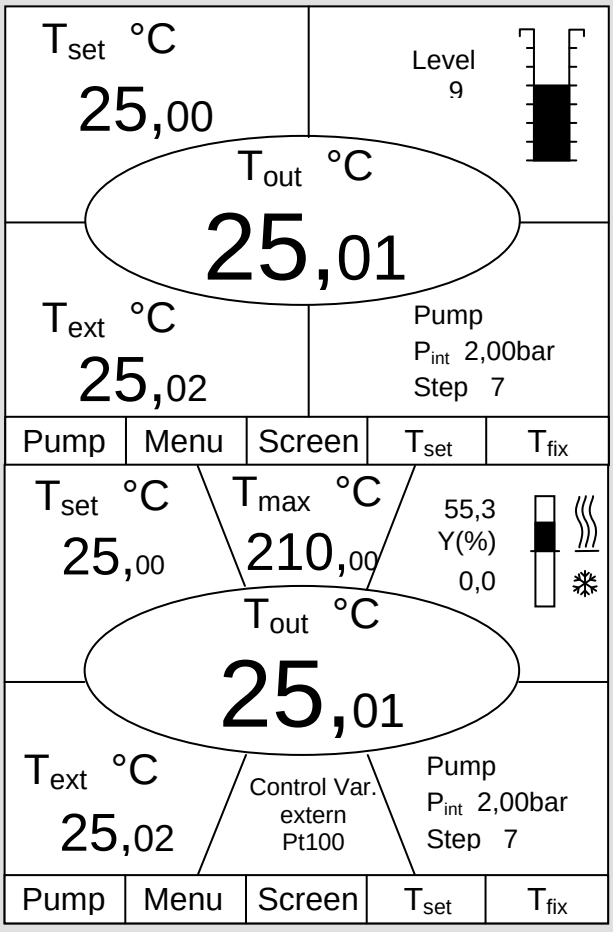
The brightness and contrast can be set on the Command remote control:

- The works setting can be changed via à Settings à Basic settings à Display à Brightness or à Contrast.
- The brightness of the LCD illumination can be selected from 8 steps or switched off completely.
- The contrast can be set in 8 steps.

Screen

There are six different screen displays available.
The screen is switched over with the soft key Screen:





1. **Basic window** with the three most important items of information:

- T_{out}, current outflow temperature,
- T_{set}, set point of the outflow temperature or external temperature,
- Information: Heating / cooling. Here, heating is taking place at 55.3% and 0.0% cooling.

Soft keys:

- Pump: Set Pump level.
- Menu: Set unit parameters.
- Screen: Changes between basic, normal, super, graphics recorder windows and the process overview.
- T_{set}: Changes setpoint temperature.
- T_{fix}: Calling and setting of saved setpoints.

2. **Normal window** with five important items of information:

- T_{out}, current outflow temperature,
- T_{set}, setpoint,
- T_{ext}, current temperature on external probe (if connected),
- Current level of the heat transfer liquid,
- System pressure in the outflow and pump level of the Vario pump.

Soft keys as above.

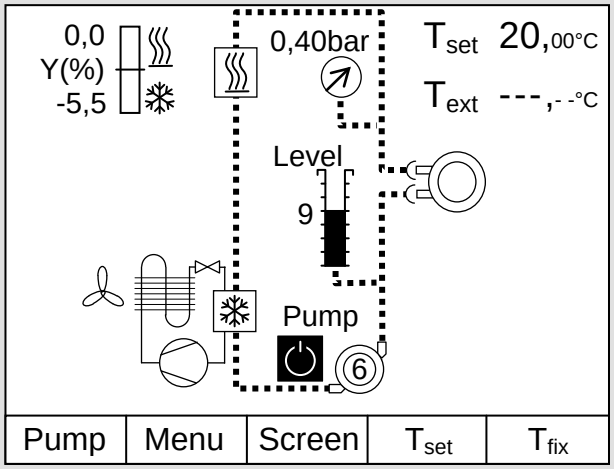
3. **Super window** with seven items of information:

- T_{out}, current outflow temperature,
- T_{set}, setpoint,
- T_{ext}, current temperature on external probe (if connected),
- T_{max}, Overtemperature cut-off point,
- Control to T_{out} or $T_{ext,}$
- Information: Heating / cooling,
- System pressure in the outflow and pump level of the Vario pump.

Soft keys as above.

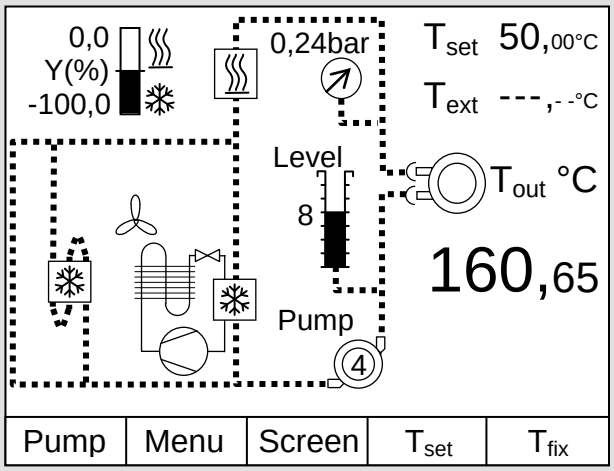
4. Graphical measurement display

- All temperature values can be shown graphically against time (þ 7.12).

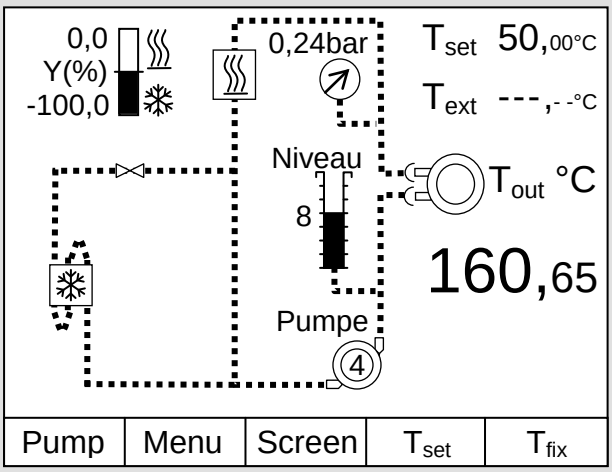


5. Process overview window
   - T_{out}, current outflow temperature,
   - T_{set}, setpoint,
   - T_{ext}, current temperature on external probe (if connected),
   - Controller to T_{out} or T_{ext} , the controlled value is shown large,
   - System pressure in the outflow,
   - Pump level, Level of heat transfer liquid,
   - Information: Heating / cooling,
   - Pictogram standby (þ 7.3).

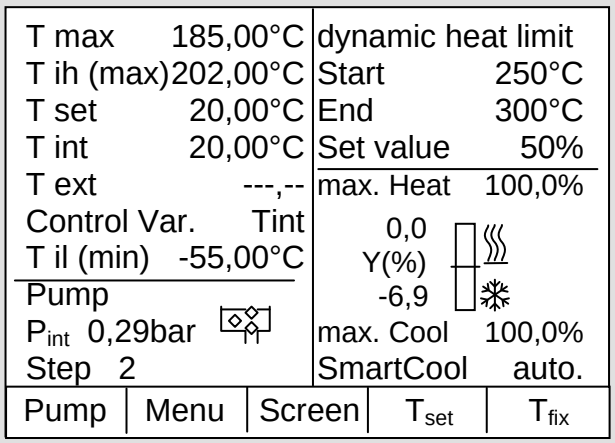
Soft keys as above.



Picture on the left: Process overview of a device with high temperature cooler HT.



Picture on the left: Process overview of a high-temperature thermostate

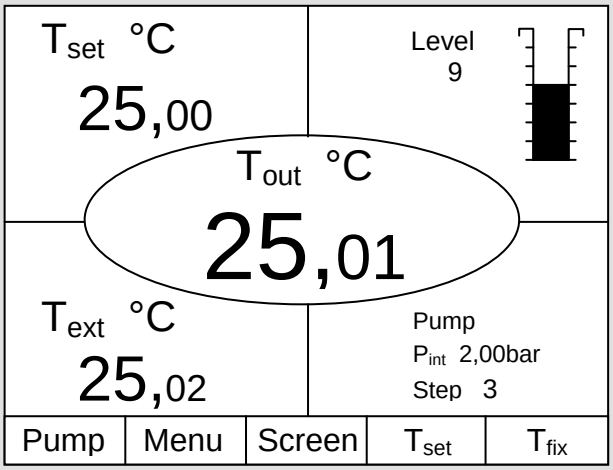


6. Window limits

- T_{max}, (þ 7.16.1),
- T_{ih}, T_{il} (þ 7.10.2),
- dynamic heating limit (þ 7.15.7.2),
- max. heating, cooling and Smart Cool (þ 7.15.7.1),
- pictogram for degassing (þ 7.6.3).

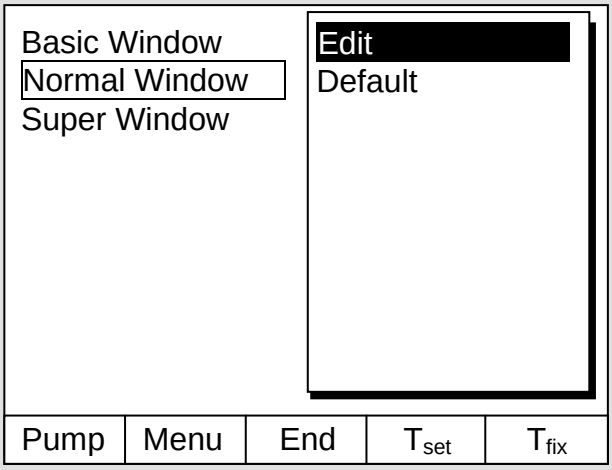
7.4.2 Changing window information (Command remote control)

Command | **Display info**

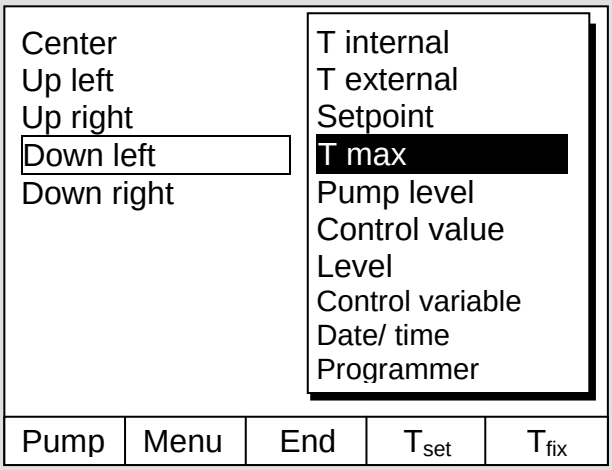


You can adapt the information displayed by your Command remote control to your requirements. For example, if you have not connected any temperature probe, you can exchange it in the standard setting of the normal window for the maximum temperature T_{max} (safety cut-off).

This is how it is done:



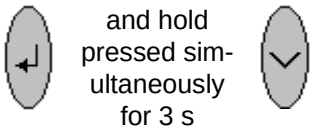
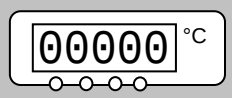
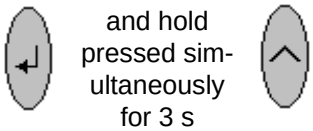
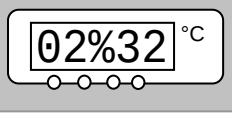
- Open the device parameter menu via the soft key Menu .
- With → and ↓ change from
  Settings à
  Display Data à
  Normal Window à to
  Edit



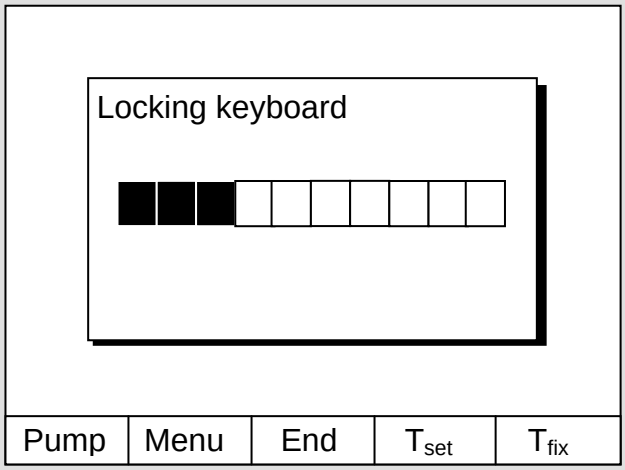
- ↵ or → takes you to the illustrated window.
- → and ↓ marks T max as illustrated.
- Confirm selection with ↵ or End ,
- or quit the window with esc without any changes being made.

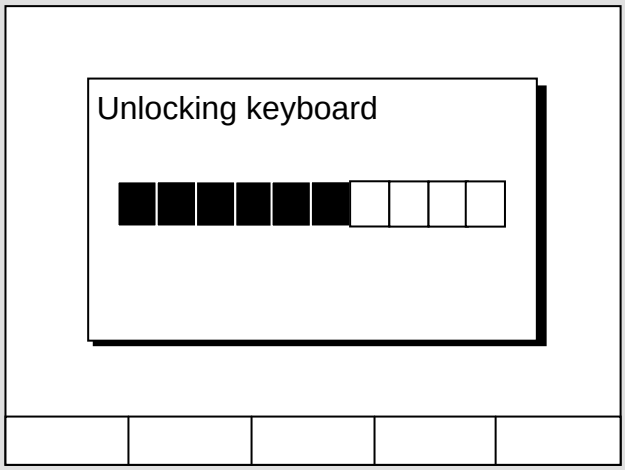
7.4.3 Locking the keyboard

The keyboards of the Master console and Command remote control can be locked independently of one another. This is particularly advantageous when the thermostat is located in another room and the Command remote control is used as a remote control. Then the Master keyboard can be locked to prevent unintentional alteration of setting.

Master	SAFE
 and hold pressed simultaneously for 3 s	**Locking:** - SEt appears for 3 seconds, - then the segments of the first right 0 are formed,
	- hold both keys pressed until the display can be seen completely.
	- SAFE flashes briefly and the display returns to the actual temperature. - The Master keyboard is now locked. - The SAFE display signals the locked condition when any Master key is pressed.
 and hold pressed simultaneously for 3 s	**Unlocking:** - for 3 seconds, then SAFE appears. - Then the segments of the left 0 are formed.
actual outflow temperature 	- When all 0s have been formed, the actual temperature reappears.

Command





Locking:

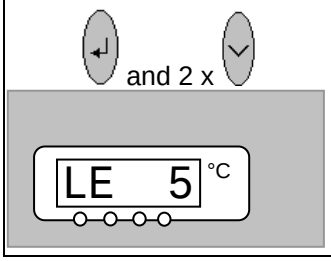
- First press and then hold simultaneously pressed for 3 s.
- The Locking window appears.
- Hold both keys pressed until the progress bar is completely filled.
- Then the display skips back into the previously set Screen mode,
- The softkey boxes are now empty, signaling that the keyboard is locked.
- On pressing any Master key the display appears:
  Keyboard locked!

Unlocking:

- First press and then press and hold simultaneously for 3 s.
- The Unlocking window appears.
- Hold both keys pressed until the progress bar is completely filled.
- Then the display skips back into the previously set Screen mode.

7.5 Level display

The level display renders the current liquid level in the expansion vessel visible.

Master	LE
	- Call level display **LE**. - The current level indication is displayed (here 5).

Command	Display in the various windows of the Command remote control is possible (þ 7.4.1).

Significance of the level indication

0	Low level alarm (þ 7.16.2)
1	Low level warning (þ 7.16.2)
1 – 14	Stable operation possible.
15	High level (þ 7.16.3 and 7.16.4)

Estimating the filling amount per step of level indication

The range of level indication steps 1 to 15 corresponds to the additional filling volume in the expansion vessel (þ 11).

Example:

Additional filling volume in the expansion vessel for Integral XT 150: 5.5 liters.
Volume per level indication step (average): 6 liters / 14 level indication steps = approx. 0.4 liters.

7.6 Filling, venting and degassing

Your Integral XT has no bath which actively takes part in the temperature stabilization. There is however an expansion vessel which is filled with the liquid. The liquid passes to the external loads via the internal piping and the connected hoses.

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- The devices are rated for use with non-flammable and flammable liquids according to DIN EN 61010-2-010. The temperature in the expansion tank must not rise more than 25 °C below the flash point (þ 1.2).
- With the use of heat transfer oils note that they expand on heating (approx. 10%/ 100 K).
- Set the lower and upper temperature limits (þ 7.10.2) such that the limits for the heat transfer liquid are not infringed.

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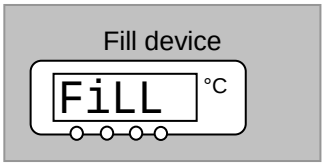
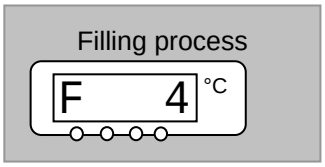
- Close the drain taps.
  1 tap for XT 150, XT 250W ... up to max. 4 taps with XT 750 H and larger.
- Check whether the sealing caps on the drains (1 to 4 depending on the thermostat) are tight. Tighten only slightly with an open-ended wrench (AF19).
- Before filling, remove all the residue of the previous liquid (þ 7.8).

7.6.1 Filling



- Switch on the thermostat.
- The filling with the filling program starts automatically if a low level is found when the device is switched on.
- With Tmax enter the maximum permissible liquid temperature (þ 7.16.1).
- Start filling. When Level 1 is reached, the display changes to F and shows the corresponding level indication.



- Minimum device filling volume (þ 11).
- Alternatively, watch the level indication as displayed on both, the Master or Command control head.

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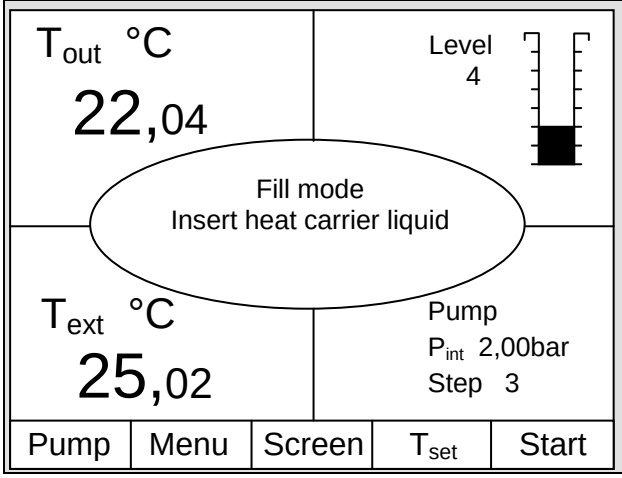
- Fill the heat transfer liquid at room temperature up to Level 4.
- Only operate the thermostat when flow in the load system is possible. Open any shut-off taps in the load.
- During filling, the device can overflow if the load is located higher than the device and the filling is interrupted (e.g. mains failure). There may still be large quantities of air in the load which allows a return flow of the filled liquid. In case of doubt a shut-off tap should be fitted on the lower load connection.

Command	Filling mode

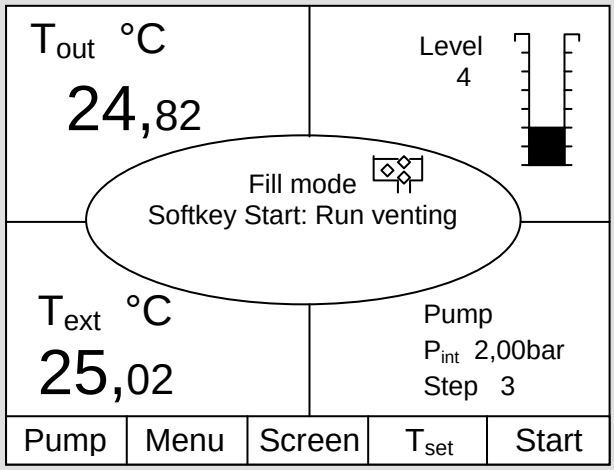


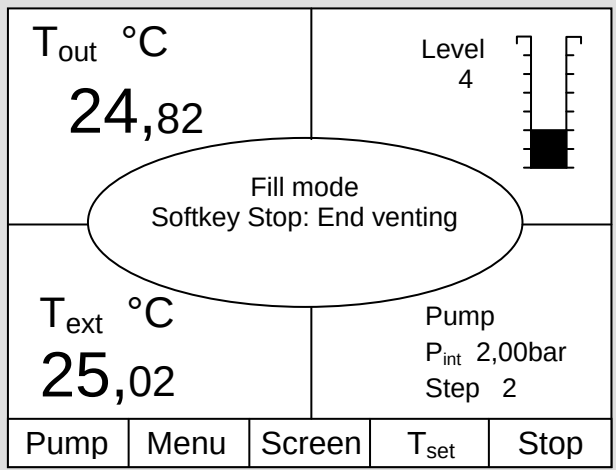
The filling window appears automatically when the level is too low on switching on the device. It can however also be started manually:
Menu à Pump à Start filling mode.

- Fill with heat transfer liquid as described above up to Level 4.

7.6.2 Venting

Command	Filling mode





After the filling process there is normally air/gas in the system which can originate from the following sources:

1. Residual air from the hydraulic circuit.
2. Highly volatile constituents of the heat transfer liquid.

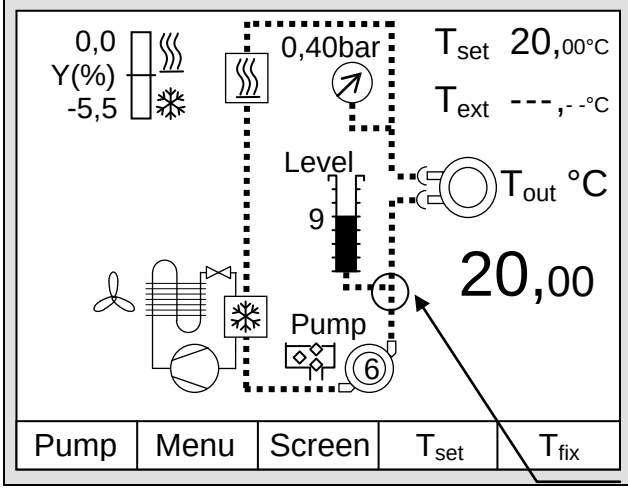
Remove residual air from the circuit:

- Start venting with the soft key Start. F indication in Master display starts to flash.
- Device comes out of the standby mode.
- Pump runs up automatically to Power Level 2, and switches off briefly every 45 seconds for improved venting. The heating and refrigeration unit are switched off. Follow the pressure and level indications until the level falls no further, the pressure indication no longer rises and the degassing symbol is no longer displayed for more than at least two minutes. This takes at least a few minutes and can take more than an hour under unfavorable conditions with large-volume loads and high viscosity.

- With devices up to 300 °C operating temperature range (H devices) switchover occurs alternately every 20 seconds between the individual hydraulic paths. When this happens, a long whirring sound is heard for about 5 seconds and the displayed pressure changes.
- Terminate the filling mode with the soft key Stop.
- A venting valve (þ see drawing on page 34 for arrangement) can significantly simplify the venting process. To do this, carefully open the valve periodically and allow air to escape until liquid is emitted from the valve, close the valve again. Collect the liquid in a suitable container. Open the valve again at regular intervals until no more air is emitted.

7.6.3 Degassing

Command

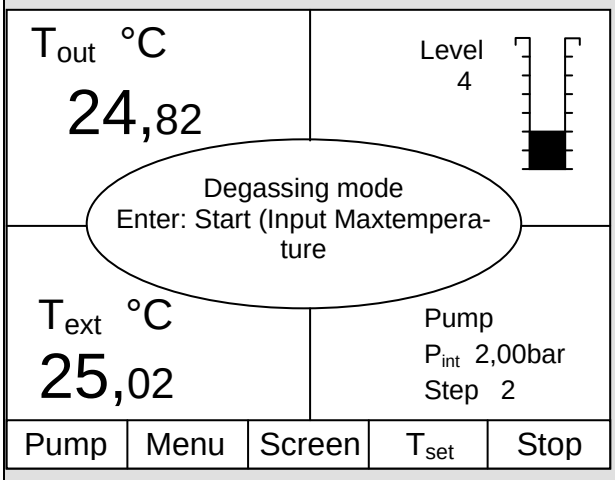


Degassing (expelling low-boiling solvents):

- Principle: During degassing the heat transfer liquid is in the boiling state. The gas can arise at various points in the circuit (e.g. heater, throttle point).
- A gravity separator, through which the gas is passed into the expansion tank, is positioned in front of the pump.

7.6.3.1 Automatic degassing program

After filling and venting, the heat transfer liquid should be heated up to 20°K above the later maximum operating temperature (note the maximum temperature range of the heat transfer liquid (þ 6.2)), note the maximum working temperature range of the connected consumer).



- The degassing program should be carried out to automate this first-time degassing:
- Enter the maximum temperature up to which degassing is to take place. To do this, press the key "Enter", enter the new set value and confirm it.

- With this program the following parameters are automatically set:
  - The pump level is set to Level 2. The pump level should only be changed when necessary (þ 7.9.3).
  - The heater power is reduced, round about 50 % (þ 7.15.7.1).
  - The cooling unit is switched off (þ 7.15.7.1). The outflow temperature may rise above the setpoint due to the heat input from the pump.
  - Pressure control is not recommended (þ 7.9.4). Take care to the selection of the pump level with pressure sensitive loads (e.g. glass apparatus). Pay attention to a maximum permissible operating pressure.
- As with venting, the pump switches off briefly every 45 seconds for improved degassing.
- With units up to 300 °C, after briefly switching the pump off, switching occurs between the cooling unit and the high temperature cooler under certain operating conditions. So that it can be ensured that both, the cooling unit and the high temperature cooler are degassed. In addition, flushing occurs every 20 K.
- To simplify the removal of low-boiling solvents during out gassing, it may be practical to open the cover of the filling point so that the vapor can escape more easily (use air extraction if required). In this operating state, check the device continuously; it is essential to keep sources of ignition away from the filling aperture and to protect the operating personnel from splashes (e.g. place the cover diagonally on the filling aperture). Appropriate protective equipment and clothing must be worn. Close the cover again at the end of degassing.
- The end of degassing is reached when the outflow temperature has approached the set temperature (<10 K) and does not increase further. Similarly, the end of the degassing is reached when the outflow temperature has exceeded the set temperature due to self-heating.
- Terminate the degassing program with the softkey Stop. The device is then in the standby mode. All the above described parameters are reset to the previous settings.

7.6.3.2 Permanently and automatic degassing

- The device carries out the degassing permanently and automatically further on. When the device finds gas, first the heating and cooling power is reduced or sometimes completely switched off. If the pump pressure falls significantly (clear sign of degassing), the pump speed is limited, and the pump may switch off briefly. The device then starts up again automatically.
- With devices up to 300 °C and after the pump switches off briefly, switchover occurs between the cooling unit and the high temperature cooler in certain operating conditions. This ensures that both the cooling unit and the high temperature cooler are degassed.

7.6.4 Topping up

- Topping up during operation is possible. Volume per level indication step (þ 7.5).

7.7 Draining

Start draining

- On the floor-standing device the drain taps and drain points are located on the right side of the housing, on the bench-top model they are on the front panel at the bottom right.
- Use the draining program so that the valve settings for draining in the hydraulic circuit are optimum.
  Menu à Pump à **Start draining**.
- Drain the heat transfer liquid via all the drain taps (1 to 4 depending on the device). To do this push on a hose.

Drain tap and draining points

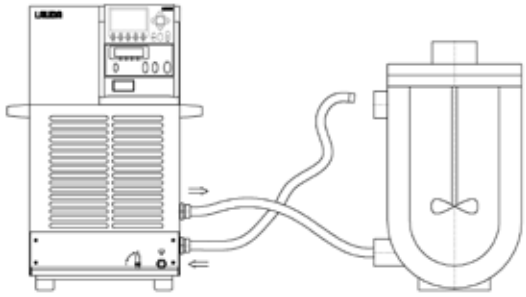
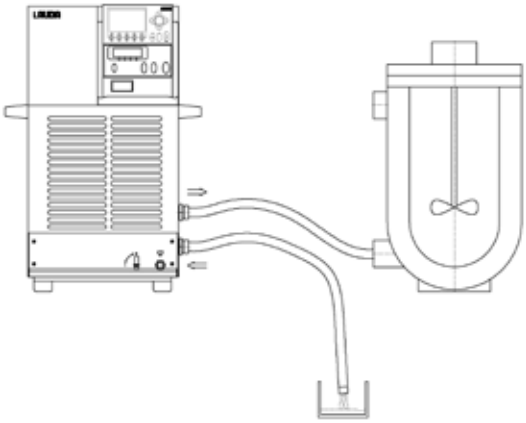
- Follow the regulations for disposing of the used heat transfer liquid.
- Use all available drain taps to achieve optimum draining.

+

Do not drain the heat transfer liquid in the hot state over 90 °C or below 0 °C.

Draining residues XT 150, XT 250 W

After draining, liquid residues may still be located in the return hose.
Proceed as follows: Draining residues

1. Remove the return hose from the load.	2. Empty the residue from the hose into a container.
	

7.8 Changing the heat transfer liquid and internal cleaning

After draining there are residues of heat transfer liquid in the device depending on the type of liquid was used.

Remove these with the following cleaning procedure:

1. Connect a short-circuit hose to the outflow and return (þ 2.3).
2. Fill the device with a suitable cleaning liquid whilst operating in the filling mode (þ 7.6).
   If water with a cleaning agent (fat solvent) is used, it is essential to ensure that the device is only operated in the filling mode (refrigerating machine is therefore off). Otherwise there is the risk that the device may ice up internally and be damaged.

Suitable cleaning liquids	for
Acetone (solvent) *It is essential to follow the relevant safety precautions when using acetone!*	Kryo 55 Kryo 85 Ultra 350
Water	Kryo 30

3. Drain (þ 7.7) and remove the short-circuit hose. Dry the device with compressed air. To do this, carefully allow compressed air to flow into the device, alternately via the outflow and return. If cleaning is carried out with liquids which readily dissolve oil, such as acetone, do not let the unit stand dry or transport it dry for a longer period (more than one day), because the pump requires a minimum lubrication. Therefore, continue with point 4.
4. After cleaning, fill with new heat transfer liquid and vent (þ 7.6).
5. If contamination is still found (remove 0.5 liters with draining program (þ 7.7)), it is recommended that the new heat transfer liquid is again changed and cleaned externally, or the residues of the old heat transfer liquid are separated.

+ If residues of an old heat transfer liquid are not removed and remain in the device and the device is then operated above the thermal loading limit for this heat transfer liquid, deposits may form, particularly on the heaters, which reduce the performance capacity of the device or even reduce the service life of the device.

7.9 Important settings

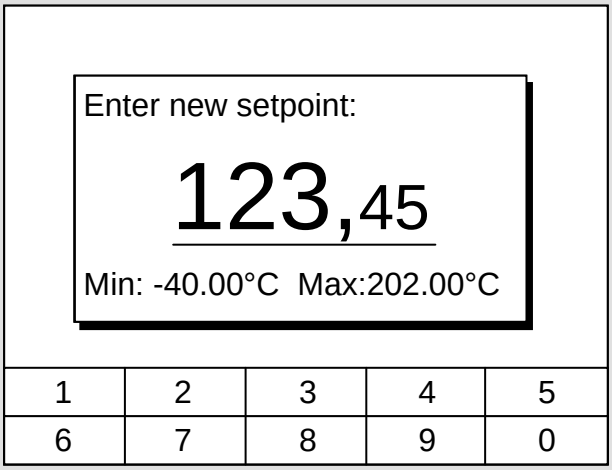
7.9.1 Temperature setpoint setting

The setpoint is the temperature which the thermostat should reach and maintain constant.

Master (main level)	SEt
	- Press key until SEt (Setpoint) appears.
	- Press, display flashes.
or	- Enter the setpoint with the two keys ((þ 7.4.1) General key functions and pilot lamps).
Wait 4 seconds or	- Display flashes 4 s à new value is automatically accepted, **or** value is accepted immediately with Enter key.
+	- For safety reasons the setpoint can only be set up to 2 °C above upper limit of the operating temperature range for the relevant device type. - In the following cases the manual setpoint entry is blocked: Setpoint is taken from the analog module, from the programmer in the Command remote control or via the serial interface. - When the setpoint temperature is to be lowered, it may take up to one minute before the blue LED ❄ lights.

Command | T_{set} or T_{fix}

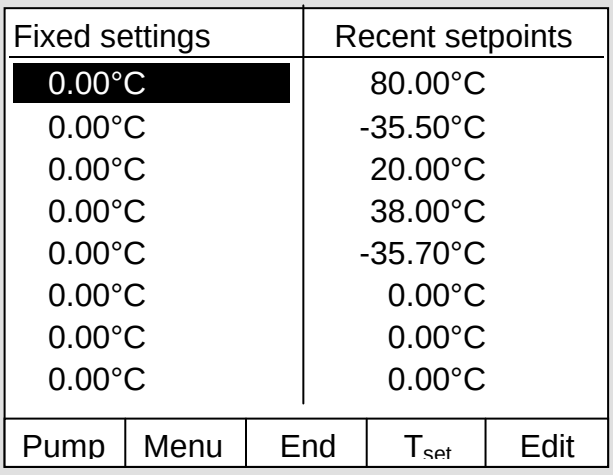
- or the soft key T_{set} opens the setpoint window.
- **123.45** is the setpoint which is still active. The upper and lower limit temperatures are displayed (device-specific values).



There are three different possible entry methods:

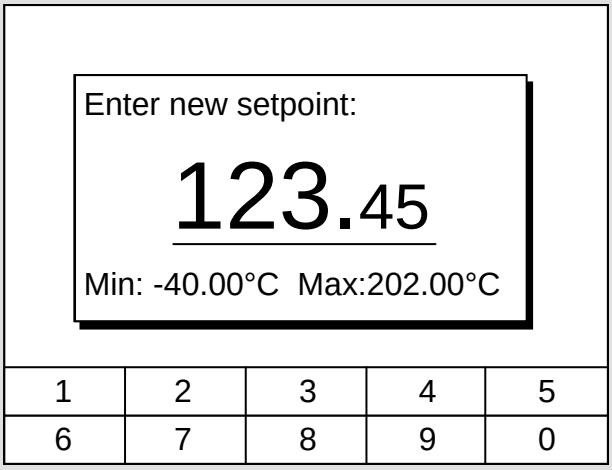
1. Change the value with the or keys. First you vary the 1/10°C values. If you hold the key pressed longer, then full degrees change.
2. Enter the complete number with the numerical duo keys and the key for the negative sign and decimal point.
3. Using or , move the flashing cursor line to the decimal place which you would like to change and then change it with or .

- Confirm the value with or quit the window with without having made any changes.



Two other ways of entering the setpoint:

- With the soft key T_{fix} open the window shown on the left.
- The setpoints which you last entered are shown in the right-hand column. In the illustrated screen the last setpoint was 80.0°C.
- To accept an earlier setpoint, enter the right-hand column with and select the desired value with , then accept it with or cancel with .
- In the left-hand column, setpoint temperatures which are to be used frequently can be defined as "fixed settings".



- Select desired position with the cursor keys (black background).
- With the soft key Edit open the window shown on the left.
- Enter fixed temperature setpoint as described above and accept into the list with or cancel with .
- Select and accept values from the list of fixed settings as described above for the "Recent setpoints".

7.9.2 Displaying the actual external temperature

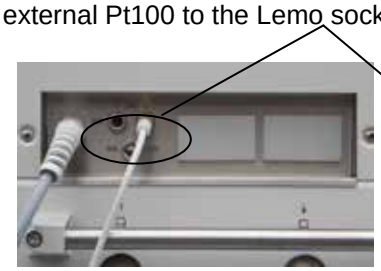
With all Integral XT Thermostats an external temperature probe can be connected, which for example.....

1. ...can be used as an independent temperature measurement channel,
2. ...can be used as the controlled variable for the bath temperature in applications with a noticeable temperature gradient (between the internal bath temperature and an external load). The setup is described in Section (þ 7.9.6). With the function described in the following, you only change over the display.

\+ - External actual temperatures can also be read in by interface modules (þ 8).

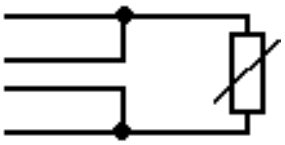
Connection of the external Pt100 to the Lemo socket 10S.

Bench-top device



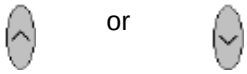
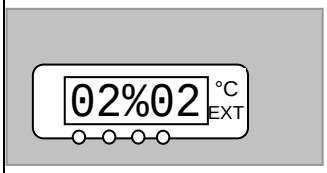
Floor-standing device

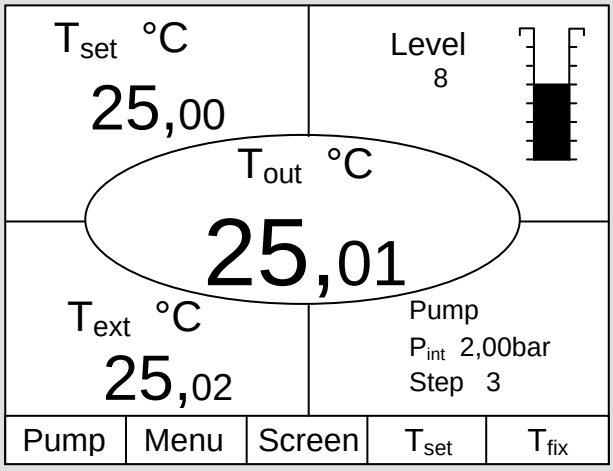
Contact on socket 10S			
1	+	I	Current circuit
2	+	U	Voltage circuit
3	-	U	Voltage circuit
4	-	I	Current circuit



Pt100
DIN EN 60751

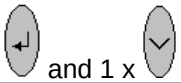
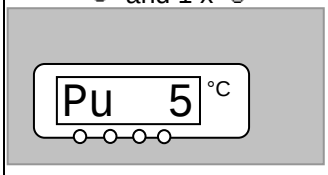
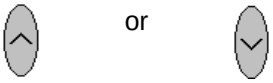
- Plug: 4-pole Lemosa for Pt100 connection (Order No. EQS 022).
- Use screened connecting leads. Connect screen to plug case.

Master	EXT
 or	- Switches to the actual-value display of the external temperature probe (or to the actual value received from an interface module (þ 8)).
	- **EXT** is lit in green next to the row of figures. - If no external Pt100 probe is connected, - - - - - is displayed.

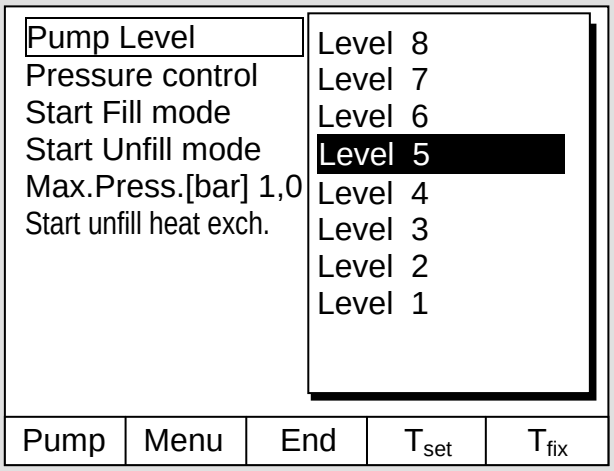
Command	T_{ext}
	- Provided an external temperature probe is connected, its value is displayed in the lower left part of the standard and super windows (applies to the works setting for the window partitioning). - External actual temperatures can also be read in via interface modules (þ 8).

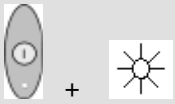
7.9.3 Pump capacity or setting standby

With the Integral XT Vario pump, 8 pump levels are available with which the flow rate and pressure, the noise generated and the mechanical heat input can be optimized. See also (þ 7.15.7.3).

Master	Pu
 and 1 x	- Call pump power levels display Pu.
	- The current pump level is displayed (here 5).
	- The pump levels display flashes.
 or	- Select pump level (pump speed = pump power): 1 to 8 for pump operation. Pump responds immediately! - 0 activates the standby function (pump, heater and refrigerating machine are deactivated).
wait 4 seconds or	- Display flashes 4 s à new value is automatically accepted, **or** - value is immediately accepted with Enter key.

Command	Pump Level





- Open the device parameter menu via the soft key Menu .
- Change from Pump à Pump Level using .
- With or you enter the illustrated window. Level 5 is active.
- Select another pump level with or and confirm with or End ,
- or quit the window with without making any changes.

Standby activation

- Standby activation
  (Pump, heater and refrigerating machine are deactivated when the green LED in the lower part of the key is lit.)

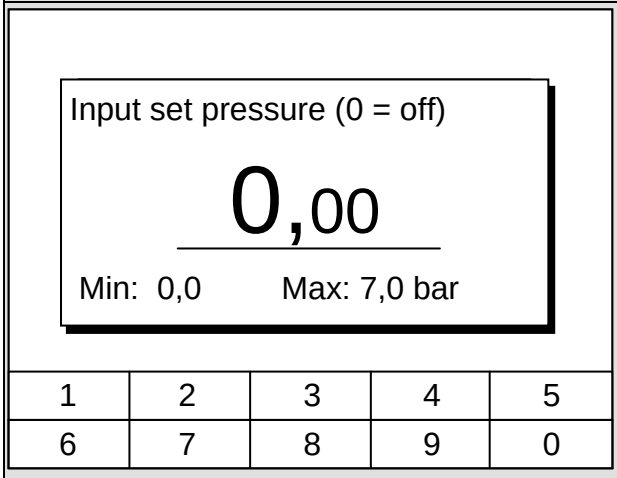
Please exercise caution when the thermostat is in standby mode. The thermostat is not switched off absolutely safely.
The following settings/ actions may start the thermostat unintentionally from the standby mode:

- A previously activated timer mode (þ 7.14), because a started timer continues to run.
- "Start" command via interfaces (þ 8).

7.9.4 Pressure control

Alternatively to the 8 pump power levels, a mode with pressure control is provided which facilitates a very effective supply of pressure-sensitive glass reactors with a maximum permissible pressure rating.

Command	Pressure control



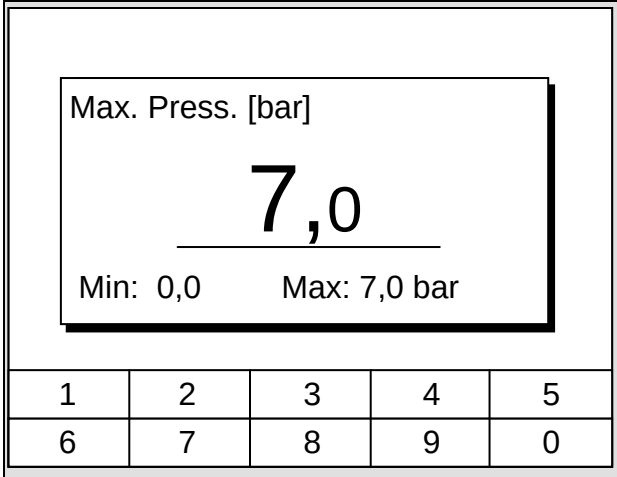
- Open the device parameter menu using the soft key Menu.
- Change from Pump à to Pressure control.
- The settings window opens.
- Enter the required pressure. The setting option with the power levels (þ 7.9.3) is thus switched off.
- In the overview display P_{set} and P_{int} are displayed.
- If a too high pressure is set which the pump cannot achieve, then the pump operates at its power limit (Level 8).

7.9.5 Maximum pressure control

With the operation of double-shell vessels or other pressure-sensitive applications, the maximum system pressure must be set (reduced).

+ - This setting does not replace the function of the component-tested safety valve (þ 1.2 and picture on page 34).

Command	Max. pressure [bar] 0.0

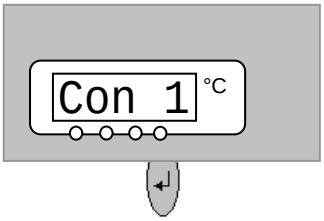
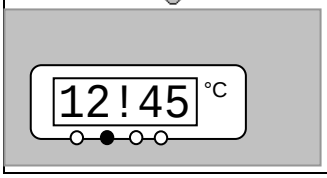


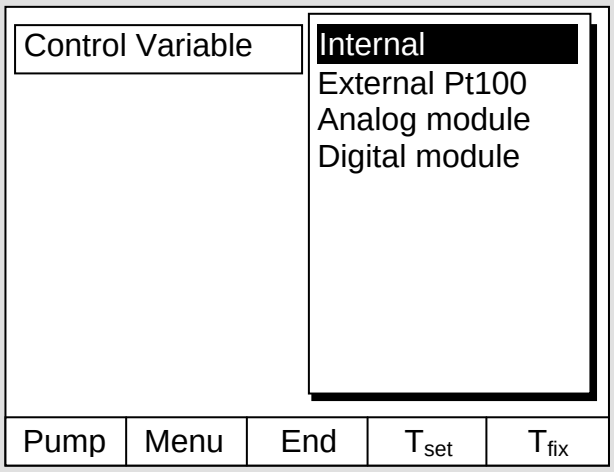
- Open the device parameter menu with the soft key Menu.
- Change from Pump à to Max. pressure [bar] 0.0.
- The settings window opens.
- Enter the required maximum pressure.
- If the set maximum pressure is exceeded, the pump is switched off.

7.9.6 Activating external control

An external temperature probe can be connected to the Integral XT Thermostats. How this is done is explained in Section 7.9.2. If the set point temperature is to be controlled using this sensor instead of the internal sensor, the setting can be made here.

Furthermore, control can also occur based on the signal from the analog or serial module (þ 4.8).

Master	**Con**
and 4 x	Call the source selection for the control **Con** .
	- The momentary setting for the source is displayed, - here 1 for internal, because control takes place using the temperature signal from the internal temperature probe. - The source display flashes.
or	Change temperature probe source: - 1 for the internal probe, - EP only when an external probe is connected, - EA only when an analog module is connected and configured, - ES only when a serial module is connected and is continuously receiving actual values from a PC.
Wait 4 seconds **or**	- Display flashes 4 s à new value is automatically accepted, **or** - Value is immediately accepted with Enter key.
	- If EP EA or ES has been selected, then the green EXT LED indicates that the control has regulated to the external temperature signal.

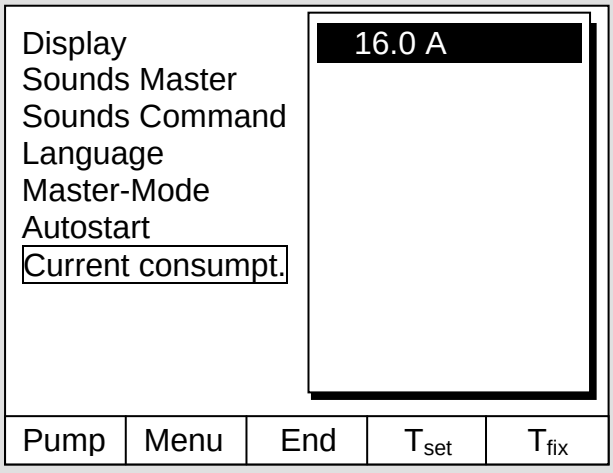
Command	Control Variable
	- Open the device parameter menu with the soft key Menu . - With the cursor keys, change further to: à Control à Control Variable . - Internal is currently active. - Select other control variables (only displayed when present) with or and confirm with or End , - or quit the window with without making any changes.

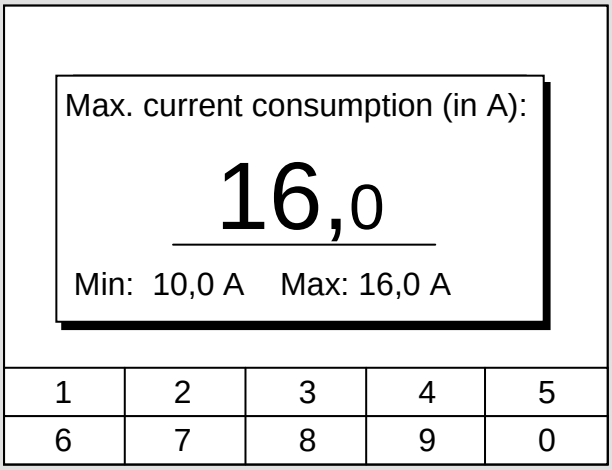
7.9.7 Current consumption from the mains

If your mains fuse is rated below 16 A, the current consumption can be reduced in steps from 16 A to 10 A using this function. The maximum heating power is then, of course, also reduced accordingly. Take into account whether other loads are still connected to the fused circuit or whether your Integral XT Thermostat is the only load.

+	Valid for single-phase alternating current devices only (e.g. XT 150, XT 250 W, XT 350 W and XT 350 HW).

With the three-phase alternating current units the current consumption cannot be reduced.

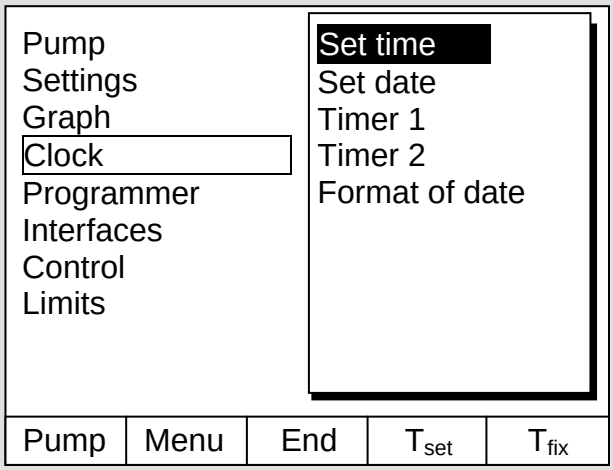
Command	Current Consumption
	- Open the device parameter menu via the soft key Menu . - With the cursor keys change further to: à Settings à Basic settings à Current Consumpt. . - 16.0 A is presently active.



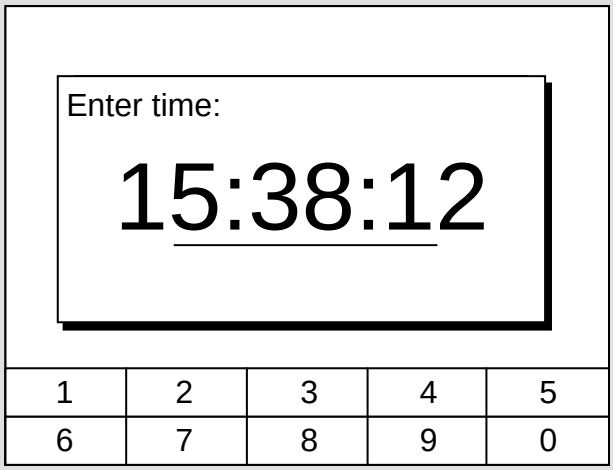
- Open the settings window with ↵.
- Change the current with cursor or soft keys and accept with ↵ or End,
- or quit the window with esc without making changes.

7.9.8 Setting the date and time (Command remote control)

Command Clock Time Date



- Open the device parameter menu via the soft key Menu.
- With the cursor keys continue to: à Clock à Set time
- or to Set date.

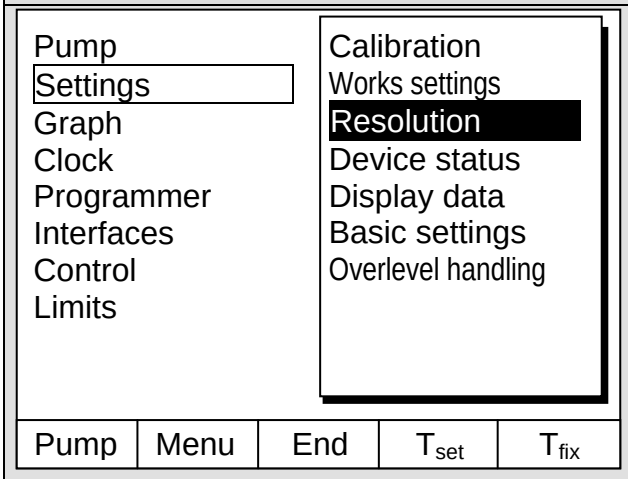


- Open the settings window with ↵.
- Change the time with cursor or soft keys and accept with ↵,
- or quit the window with esc without making changes.
- The date is set just the same with Set date.
- The date format (Day Month Year or Month Day Year) can be set under: Format of date.

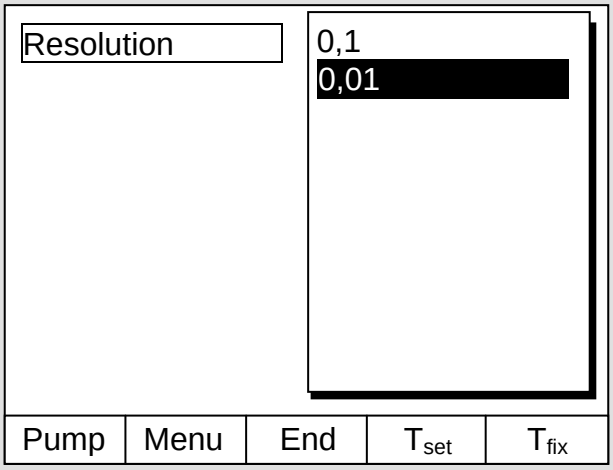
7.9.9 Display resolution setting (Command remote control)

The Command remote control allows for different resolutions of the displayed temperature.

Command | **Display resolution**



- Open the device parameter menu via the soft key Menu.
- With the cursor keys continue to: à Settings à Display resolution.



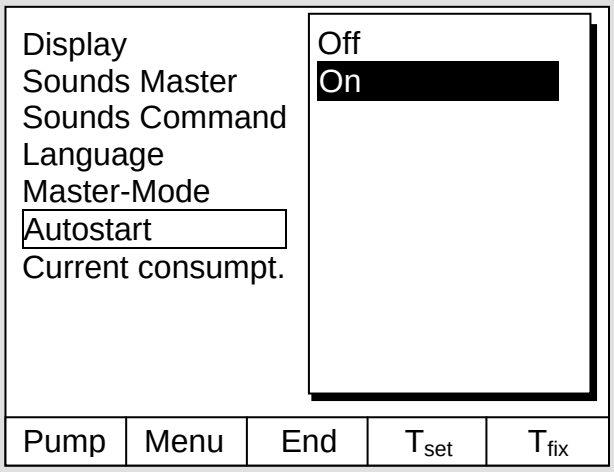
- Select the desired resolution with ↑ or ↓.
- Accept selection with ↵ or End or
- quit the window with esc without making changes.

7.10 Special settings

7.10.1 Defining the type of start mode

Usually it is desirable that the thermostat carries on operating again after an interruption in the voltage supply. However, if for safety reasons you do not wish this, you can insert an intervening manual activation step.

Command | Autostart



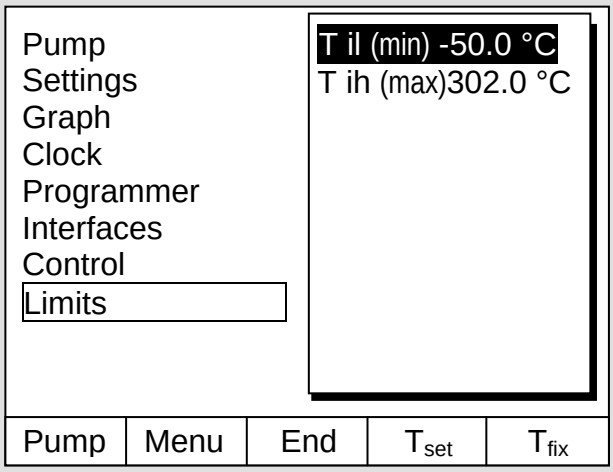
- Open the device parameter menu via the soft key Menu .
- With the cursor keys continue to: à Settings à Basic settings à Autostart .
- On is currently active.
- If the standby mode is to be activated after a mains interruption, activate "Off" with or .
- Confirm the selection with .
- Accept the change with or End ,
- or quit the window with without making changes.

+ - When the mains voltage has been restored after an interruption, you can quit the standby mode with .

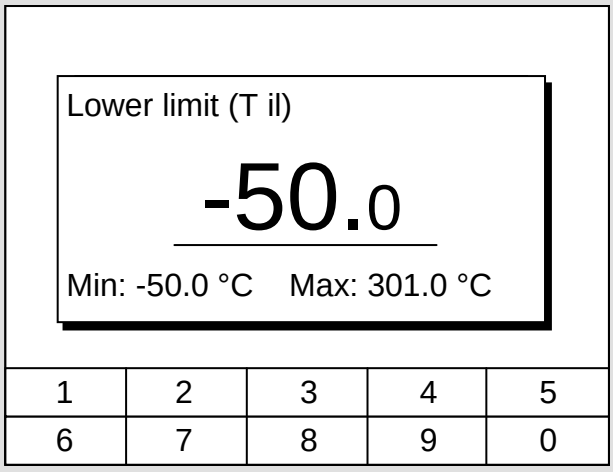
7.10.2 Defining temperature limits

With this function it is possible to define a minimum and maximum outflow temperature in the range of which the device controls as a maximum. When the temperature limits are attained, the heater or the refrigerating machine is switched off and a warning output is given. The thermostat controls down (breakaway) already 2 K before the limits. Thus the entry of a setpoint value can be prevented which would heat or cool the heat transfer liquid too strongly without a device switch-off occurring (cf. the Section “Overtemperature protection” (þ 7.16.1)). If, for example, Kryo 30 is used as the heat transfer liquid, 90 °C is the maximum temperature and -30 °C the minimum temperature.

Command — Temp. Limits



- Open the device parameter menu via the soft key Menu.
- With the cursor keys continue to: Temp. Limits.
- The minimum and maximum temperatures are displayed.
- T il (min) is currently active.
- Select the limit to be changed with ↓ or ↑ and confirm with ↵.

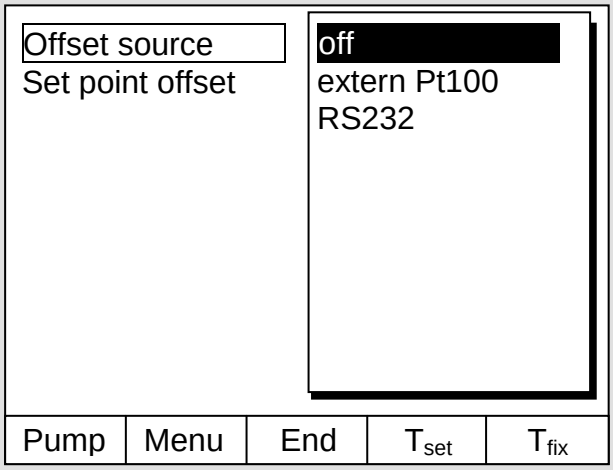


- Enter the desired limit temperature.
- Accept the change with ↵,
- or quit the window with esc without making changes.

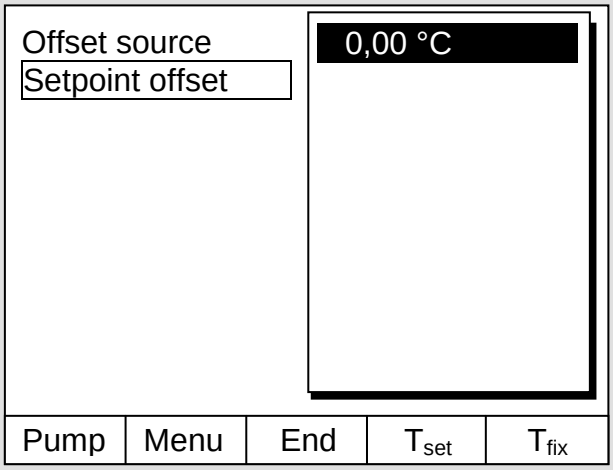
7.10.3 Setpoint offset operating mode

With this function it is possible to apply an offset value to the temperature provided by the external temperature probe or a module and then to use it as the setpoint. The heat transfer liquid temperature can, for example, be operated at -25 °C below the temperature of a reactor which is being measured by the external temperature probe.

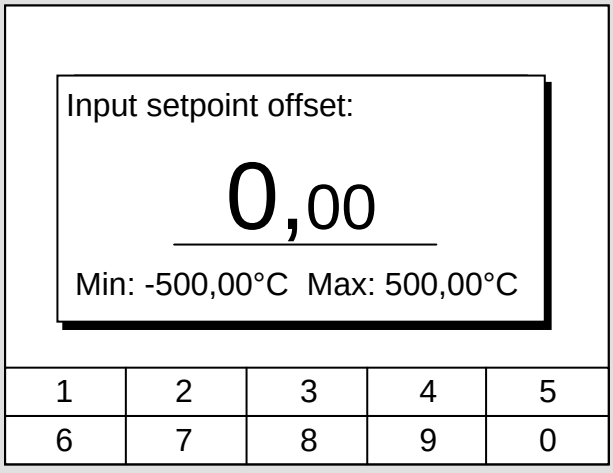
Command — Offset source and Set point offset



- Open the device parameter menu via the soft key Menu.
- With the cursor keys continue to: à Control à Setpoint offset à Offset source.
- Off indicates that the setpoint offset is currently deactivated.
- Select the setpoint source with ↓ or ↑ and confirm with ↵.
- Interfaces (e.g. RS232) are only displayed if a valid setpoint has already been transmitted.



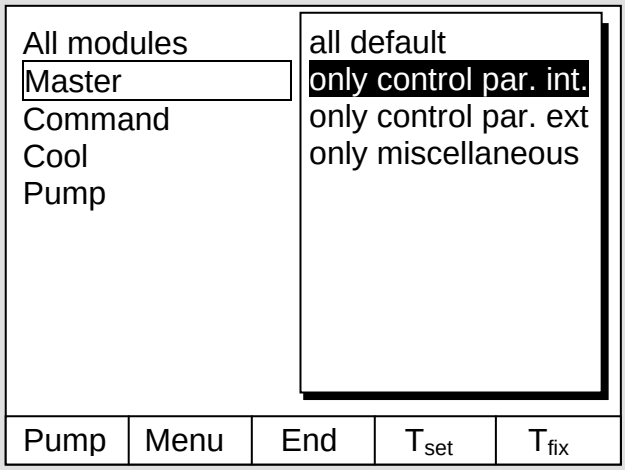
- With the cursor keys continue to: à Offset source à Setpoint offset.
- The standard value is 0.00°C.



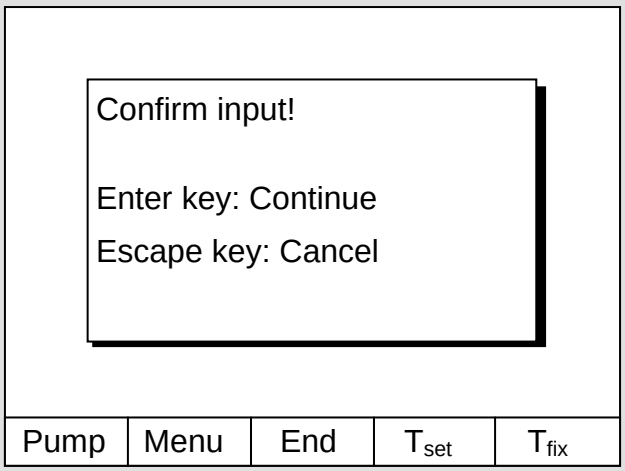
- Open the left-hand window with ↵.
- Enter the desired temperature.
- Accept the change with ↵,
- quit the window with esc without making changes.

7.10.4 Restoring works settings

Command	Works settings

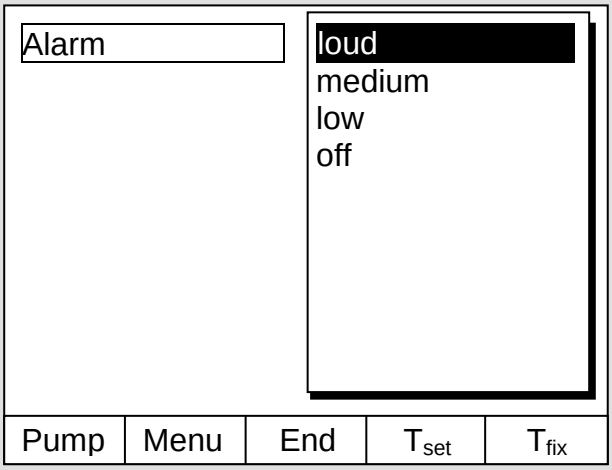


- Open the device parameter menu via the soft key Menu .
- With the cursor keys continue to: à Settings à Works settings .
- The window shown opposite appears.
- Master and then only control par. int. is shown as a possible choice. There are however various possibilities, which can be selected with ↓ or ↑:
- Under all modules Master, Command and all connected modules are reset to the works setting with all default.
- Under Master you have the choice between:
- all default, then all Master settings are reset,
- only control para. int. for the internal control parameters,
- only control para. ext. similar for external,
- only miscellaneous which resets set-point, pump level, max. current consumption, control to internal and autostart to "Auto".
- Under Command all command settings are reset with All default .
- Confirm selection with ↵.
- Confirm the control dialog shown on the left with ↵ or cancel with esc.
- Return to measurement window with End or esc.



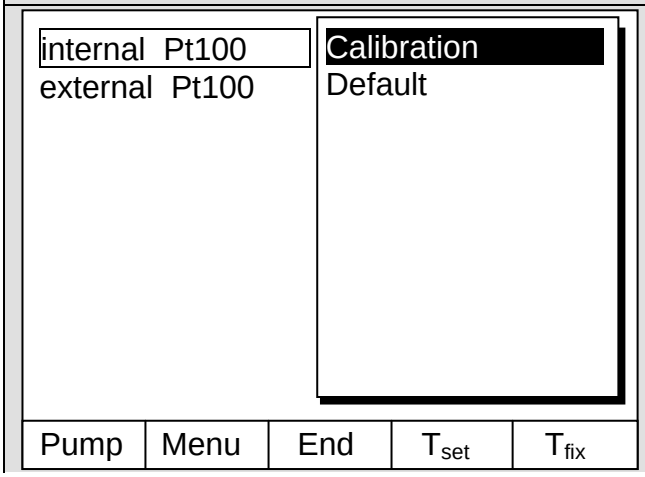
7.10.5 Setting the volume of the acoustic signals

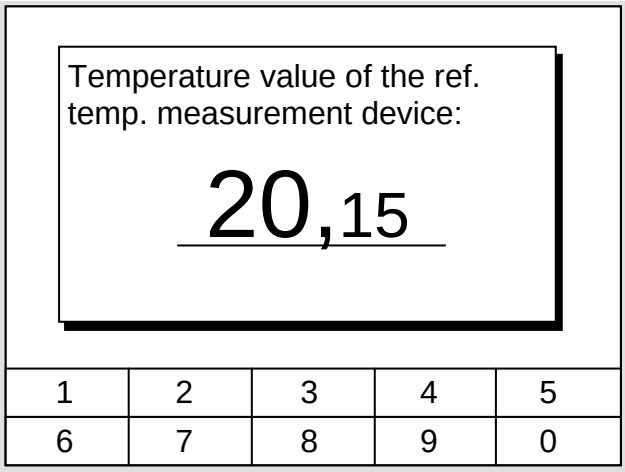
The LAUDA Integral XT Thermostats signal alarms as a dual-tone acoustic signal and warnings as a continuous tone.

Command	Sounds
	- Open the device parameter menu via the soft key Menu . - With the cursor keys continue to: à Settings à Basic Settings à Sounds Master or Sounds Command. - Select either Alarm or Warning . - Example on left: Alarm is set to loud. - Select the desired volume with or . - Accept selection with or End or quit the window with without making changes.

7.10.6 Entering the offset of the internal temperature probe

If, during checking with a calibrated reference thermometer probe, e.g. from the LAUDA DigiCal Series, a deviation is found, then the offset (i.e. the additive part of the characteristic) of the internal measuring chain can be adjusted with the following function. The reference thermometer must be fitted according to the details on the calibration certificate in the outflow.

Command	Calibration
	- Open the device parameter menu via the soft key Menu . - With the cursor keys continue to: à Settings à Calibration à Internal Pt100 à Calibration. - The window shown on the left appears. - Confirm selection with .

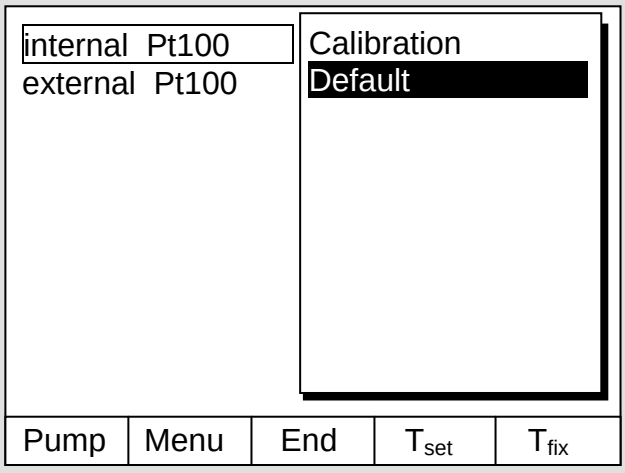


- The temperature measurement device shows the true temperature value (with glass thermometers take the correction into account where applicable).
- Change the display in the adjacent window to the true value with cursor or soft keys and accept with ↵ or End ,
- or quit the window with esc without making changes.

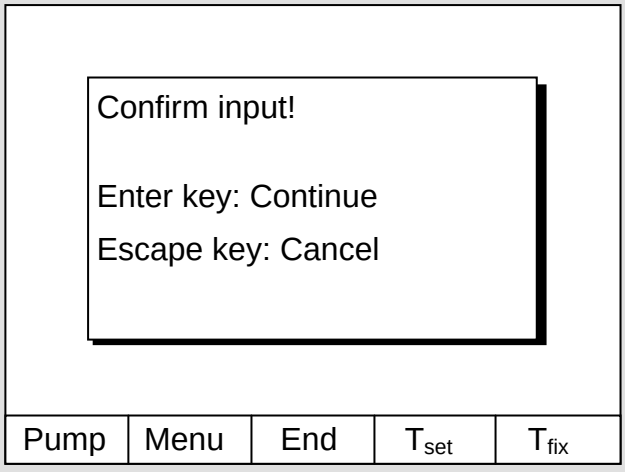
7.10.7 Restoring the works setting of the internal temperature-probe offset

If the offset has been misadjusted unintentionally, the works setting can be restored with this function.

Command Default



- Open the device parameter menu via the soft key Menu .
- With the cursor keys continue to: à Settings à Calibration à intern Pt100 à Default.
- The window shown adjacent appears.
- Confirm selection with ↵ .

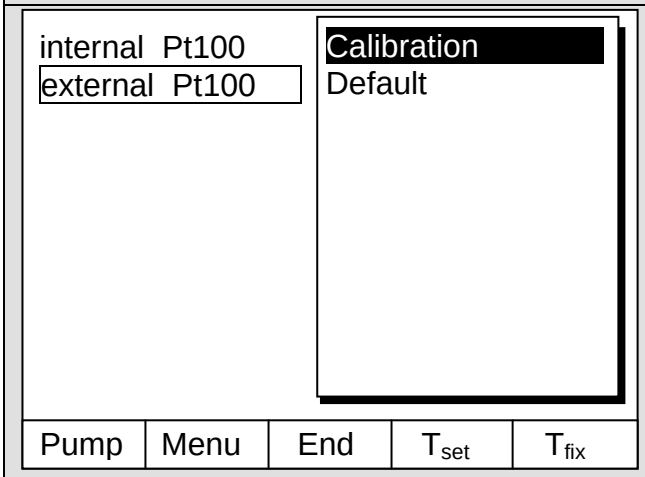


- Confirm the control dialog on the right with ↵ or cancel with esc .
- Return to the measurement window with End or esc .

7.10.8 Entering the offset of the external temperature probe

If a deviation is found during the check using a calibrated reference thermometer probe, e.g. from the LAUDA DigiCal Series, then the offset (the additive part of the characteristic) of the external measurement chain can be adjusted with the following function. The probe of the calibrated reference thermometer must be placed close to the external temperature probe (external Pt100) so that its thermal contact to the material is as good as the external Pt100.

Command	Calibration

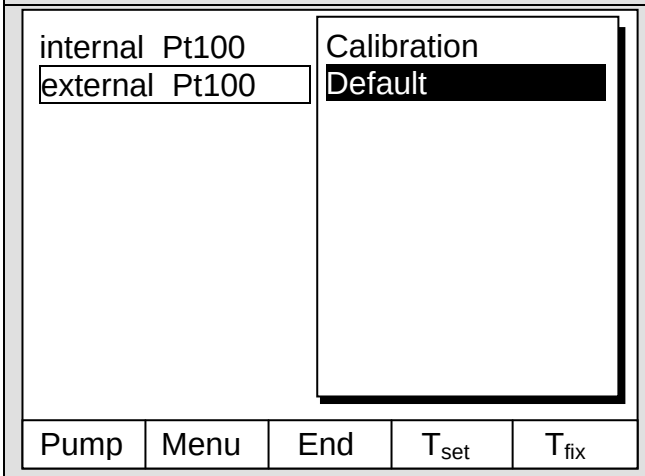


- Open the device parameter menu via the soft key Menu.
- With the cursor keys continue to: à Settings à Calibration à External Pt100 à Calibration.
- The adjacent window appears.
- Confirm selection with ↵.
- Continue as described in (þ 7.10.6) for the internal temperature probe.

7.10.9 Restoring the works setting of the external temperature-probe offset

If the offset has been misadjusted unintentionally, the works setting can be restored with this function.

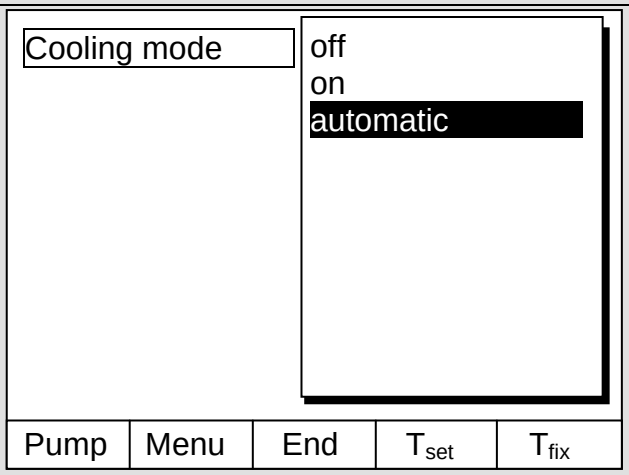
Command	Default



- Open the device parameter menu via the soft key Menu.
- With the cursor keys continue to: à Settings à Calibration à external Pt100 à Default.
- The adjacent window appears.
- Confirm selection with ↵.
- Continue as described in (þ 7.10.7) for the internal temperature probe.

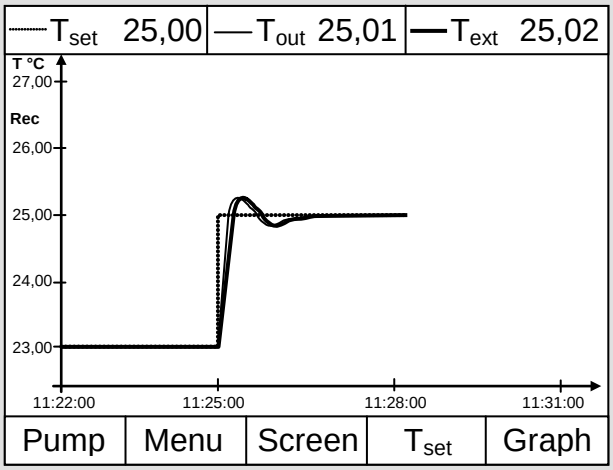
7.10.10 SmartCool

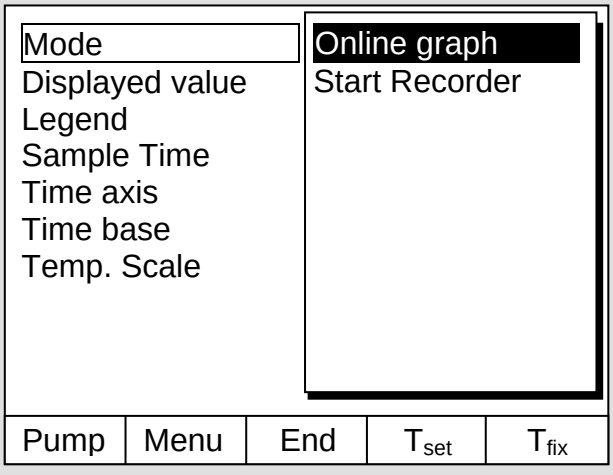
The chiller of the cooling thermostats is operated in the "automatic" operating mode as standard. Here, the cooling unit switches on or off automatically depending on the temperature and operating status. However, you can also switch the cooling unit on or off manually.

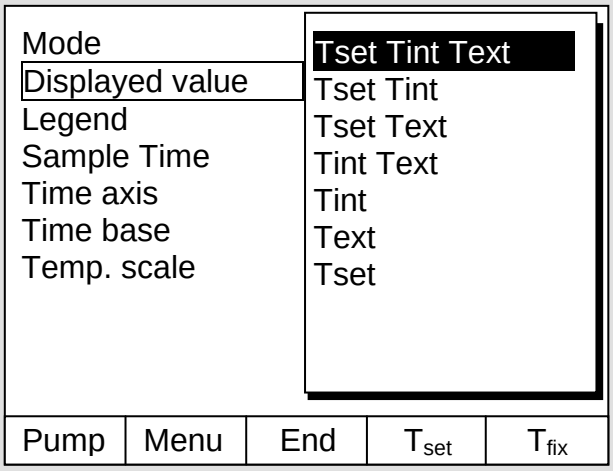
Command	Cooling mode
	- Open the device parameter menu via the soft key Menu. - With the cursor keys continue to: à Interfaces à SmartCool à Cooling mode. - The adjacent window appears. - Confirm selection with ↵.

7.11 Graphical display of temperature measurements (Command remote control)

Command | Screen and Graph







- Press the soft key Screen a number of times as required until the graph recorder window appears.
- With the soft key Graph you enter the menu for the configuration of the graph recorder.
- Mode defines,
- whether the recording is to run continuously as Online graph ,
- or whether it is to be started with Start record and later terminated with Stop record . When this start/stop mode is active, **Rec** flashes at the top left of the display.

Displayed value defines,

- which of the measurements T_{int}, T_{set} and/or T_{ext} is to be graphically displayed. In the menu all combinations are offered.

Legend defines,

- whether the axis label is to be invisible or visible .

Sample time defines with which time interval the measurements are recorded. 5 possibilities are offered:

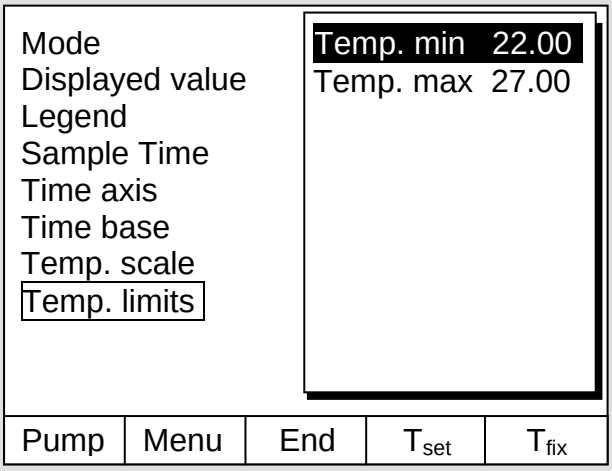
- From 2s (max. 1h45min) up to 2min (max. 105h).

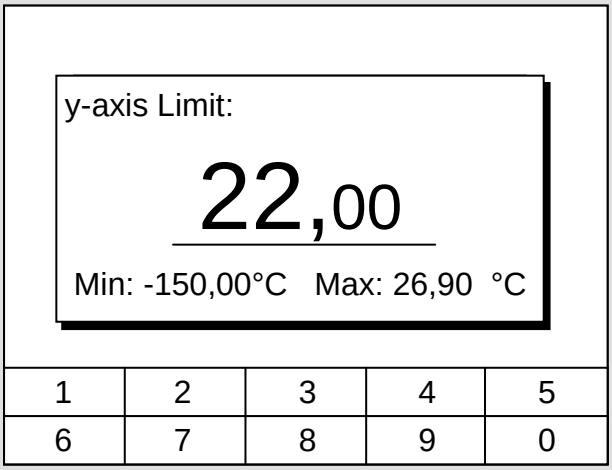
Time axis defines over which time range the measurements are to be displayed.

- With Automatic the program finds the optimum display.
- From 9min up to 144h.

Time base defines whether scaling is to be carried out.

- With Relative the start occurs at 00:00:00.
- With Absolute the current time is displayed.





Temp. scale defines how the scaling is to be carried out:

- automatic, by the program, **or**
- manual in that you yourself define the limits with the next menu point.

The minimum and maximum values for the graphical display are manually entered with Temp. limits .

- Temp. min 22.00°C is the momentary minimum value.
- Temp. max 27.00°C is the momentary maximum value.
- The highlighted value can in each case be changed with ↵. Enter the desired new value in the changes window in the usual way.
- When setting the minimum value, the largest permissible value (here 26.90 °C, since the maximum value is 27 °C) is stated.
- When setting the maximum value, it is conversely the minimum value which is entered.
- However, if a value is entered which exceeds the other corresponding limit, then this warning is issued:
  Warning: Value not in input range .

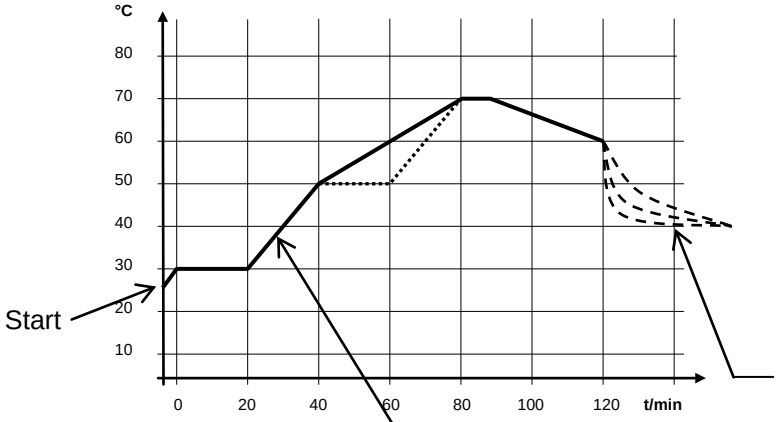
7.12 Programmer

Almost any temperature/time profile can be created with the programmer. A desired bath temperature can be approached as quickly as possible or via a defined ramp. Furthermore, the pump level and the behavior of the switching outputs can be defined. Five temperature/time programs are provided for free programming. Each program consists of a number of temperature/time segments. Also included are details of how often the program is to be executed (loops). The sum of all segments of all programs may be up to a maximum of 150.

Typical segments are:
Ramp: If a time is specified, then the segment is a ramp which is described by the target temperature, i.e. the temperature at the end of the segment, and the duration from the start to the end of the segment.
Step: Without any specified time the final temperature is approached as quickly as possible.
Temperature hold phase: No temperature change (i.e. the temperatures at the start and end of a segment are the same).

+ The programmer can be controlled or changed via the RS 232 interface, the timer or switching contacts.

7.12.1 Program example



Real program example with 6 segments

No	T end °C	Time [h:m]	Tolerance
Start	30,00°C	-------	0,00°C
1	30,00°C	00:20	0,10°C
2	50,00°C	00:20	0,00°C
3	70,00°C	00:40	0,00°C
4	70,00°C	00:10	0,10°C
5	60,00°C	00:30	0,00°C
6	40,00°C	00:00	0,00°C

Pump	Menu	End	Insert	Delete

No	Pump	Out 1	Out 2	Out 3
Start	-------	-------	-------	-------
1	2	-------	-------	-------
2	3	-------	-------	-------
3	4	-------	-------	-------
4	2	-------	-------	-------
5	2	-------	-------	-------
6	2	-------	-------	-------

Pump	Menu	End	Insert	Delete

+ Each program begins with the segment "Start". It defines at which temperature Segment 1 is to continue the program. It is not possible to specify a time for the Start segment.

Edited program example (see dashed curve in the graph on previous page).

No	T end °C	Time [h:m]	Tolerance
Start	30,00°C	-------	0,00°C
1	30,00°C	00:20	0,10°C
2	50,00°C	00:20	**0,00**°C ƒ
3 •	**50,00**°C •	**00:20** ,	**0,10°C** ƒ
4	70,00°C	**00:20** ,	0,00°C
5	70,00°C	00:10	**0,80**°C ƒ
6	60,00°C	00:30	0,00°C
7	30,00°C	00:00	0,00°C
Pump	Menu	End	Insert	Delete

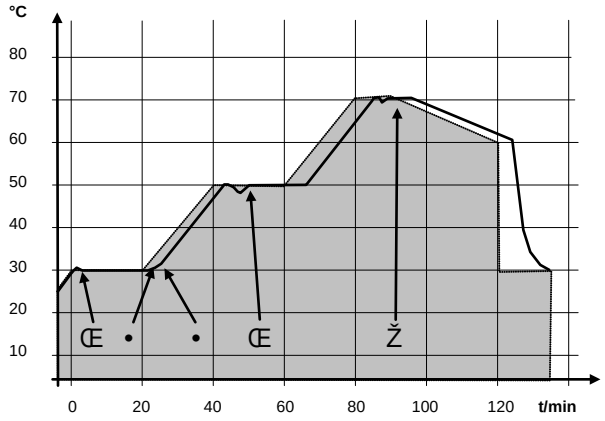
No	Pump	Out 1	Out 2	Out 3
Start	-------	-------	-------	-------
1	2	-------	-------	-------
2	2	-------	-------	-------
3	**2**	**-------**	**-------**	**-------**
4	2	-------	-------	-------
5	2	-------	-------	-------
6	2	-------	-------	-------
7	2	-------	-------	-------
Pump	Menu	End	Insert	Delete

• Insert new segment (þ Section 7.12.4).

, ƒ Change segment time or tolerance (þ Section 7.12.4).

+ **The field tolerance** (refer to the above program table and the graph below):

- It facilitates exact conformance to the dwell time at a specified temperature. Segment 1 is not processed until the bath temperature is within the tolerance range Œ, so that the ramp (Segment 2) starts delayed at • .
- A tolerance range which is too tight can however also cause undesired delays. **In particular with external control** the range should not be chosen too tightly. In Segment 5 a larger tolerance has been entered, so that the desired time of ten minutes is maintained even with settling action Ž.
- Only flat (slow) ramps should be programmed where necessary with a tolerance range. Steep ramps, which lie close to the maximum possible heating or cooling rates of the thermostat, may be severely delayed by a tolerance range that is too tight (here in Segment 2) • .



Example for the influence of the tolerance field input in case of external control:

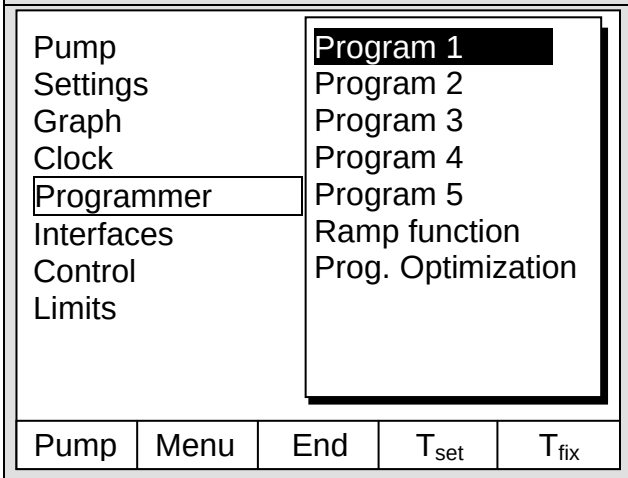
The setpoint temperature of the programmer is shown in grey.

The actual temperature in the external bath container is represented as a continuous line.

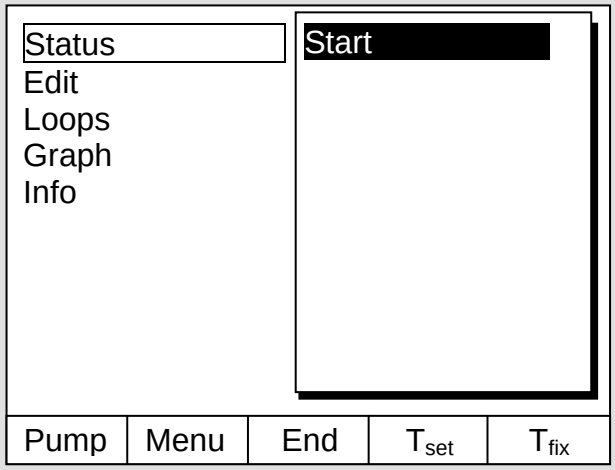
7.12.2 Selecting and starting the program (Start, Hold, Stop)

Here you will learn how to select and start a program that has already been created. If no program has been created see Creating or modifying a program (Edit) (þ 7.12.4).

Command — Programmer — Program 1

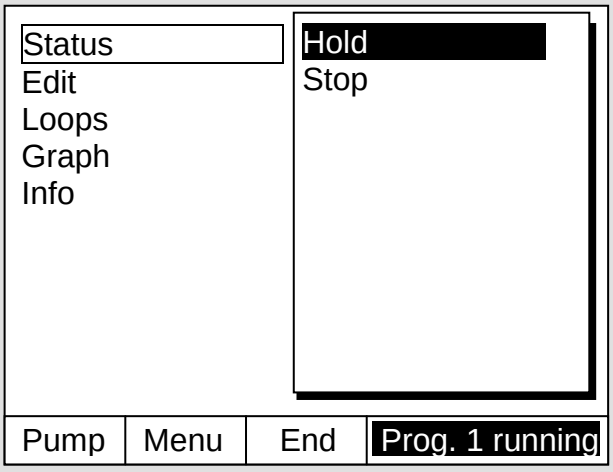


- Open the device parameter menu via the soft key Menu.
- With the cursor keys continue to: à Programmer à Program 1.
- Confirm with the key ↵.



- The submenu Status appears.
- Using the Status menu, the selected program can be:
  1. started Start,
  2. paused Hold,
  3. continued Continue or
  4. terminated Stop.
- Also the standby key stops the programmer! (Pause operation).
- After standby is deactivated, the programmer continues!

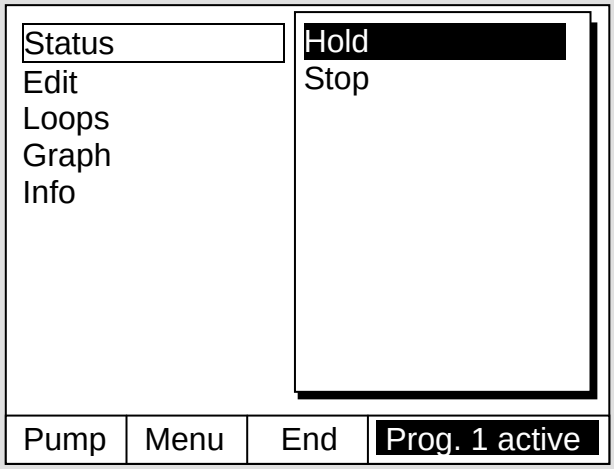
Commands which, depending on the situation, cannot be executed are not displayed. Continue therefore only appears when Hold has been activated.



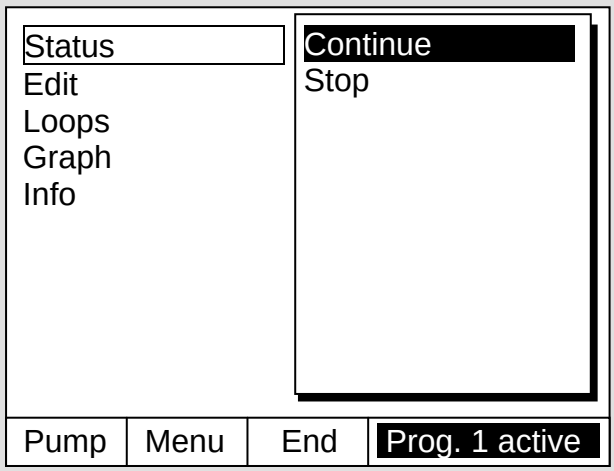
- Once the start has been confirmed with ↵, Prog. 1 running appears at the bottom.

7.12.3 Interrupting, continuing or terminating the program (Hold, Continue, Stop)

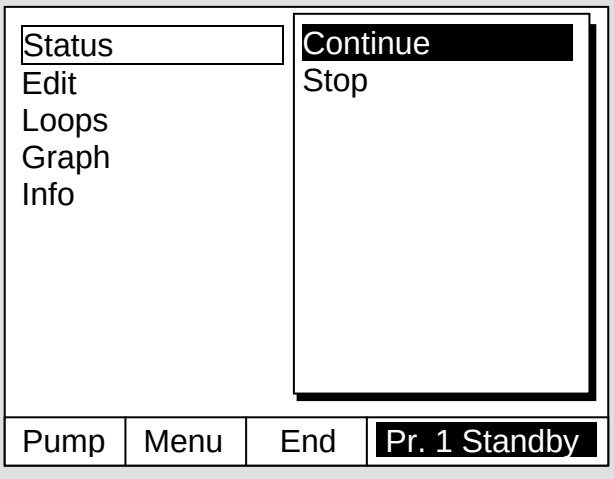
Command — Programmer | Program 1 | Status



- After a program has been started by pressing the key, the command options Hold or Stop are shown.
- Here, with the aid of the keys or and the running program can be paused with Hold or terminated with Stop.
- Once the program has been terminated, the device runs with the last setpoint setting.



- Continuation of a program paused with Hold occurs using Continue which is obtained with .



- Also the standby key stops the programmer. The pump, heater and cooling unit are switched off.
  Follow the safety information (þ 7.9.3).
- After pressing the standby key again, the programmer returns to the previously selected operating mode:
  Pause or active operation depending on what was previously selected.

7.12.4 Creating or modifying a program (Edit)

Here, there are the following functions:

- Entry of a program.
- Display of the program data of a saved program and modification of the segment data.
- Insertion or appending of a new segment.
- Deletion of a segment.

+

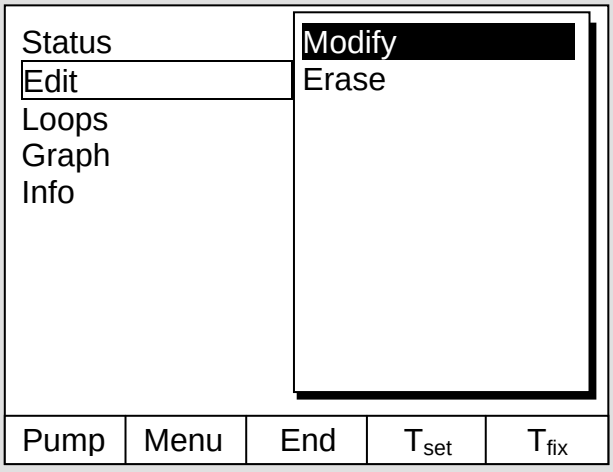
- Also when a program has just been executed, new segments can be inserted and existing ones modified, even the currently active segment. Furthermore, all segments, except the currently active one, can be deleted at any time.
- Modifications to the currently running segment are possible. The segment then continues as though the modification had been applicable since the start of the segment.

  But: If the new segment time is shorter than the segment time that has already run, then the program skips to the next segment.

- If a segment time >999 h 59 min is required, then this time period must be shared over a number of consecutive segments.

Entering a program: Program example (þ 7.12.1)

Command — Programmer | Program1 | Edit | Modify



- In the Edit menu one can Modify or Delete a program.
- Press the key.
- Continue to Modify with the key .
- There is the possibility of modifying single segments, i.e. segments can be entered as new, changed and also deleted.

No	T end °C	Time [h:m]	Tolerance
Start	30,00°C	-------	3,00°C
1	30,00°C	00:30	3,00°C

Pump | Menu | End | Insert | Delete

- In the "Start" line enter in the field "T end °C" the temperature at which the sequence is to start (default value is 30 °C). A time entry is not possible in the "Start" segment, because the thermostat immediately executes Segment 1 on reaching the start temperature.
- Delete single segments (rows) with Delete.

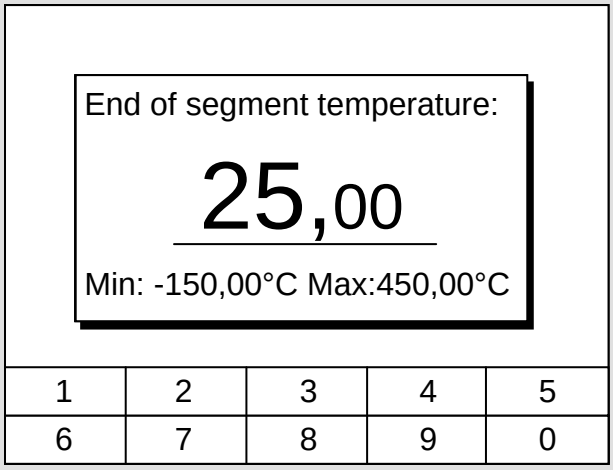
- Using the cursor keys move the black background to the field which you would like to change.
  It can be edited by pressing the key (see following pages).
- The soft key Insert inserts in the marked line a new segment which has a default value taken from the previous segment with the exception of the Tolerance field. The Tolerance is always specified as 0.00. All following segment lines will be moved one line downwards.
- In the above window Segment 1 was created in this way.
- Continue with to the fields Õ “Time” Õ “Tolerance”. See program example in (þ 7.12.1).
- If there is no entry in the “Time” field (step change in temperature), the outflow temperature is approached as quickly as possible. With a time entry the final temperature is obtained exactly after the time expires (ramp).
- When passing through a step change in temperature, the entry in the field “Tolerance” defines how accurately the final temperature is to be attained before the next segment is processed. When passing along a ramp, the "Tolerance" reflects the maximum distance between the set-point and actual temperature.

+ If the tolerance range has been selected too small, it may be that the program does not continue, because the required tolerance is never achieved.
External temperature control: Especially with ramps, a tolerance range that is too close can cause undesired delays in the start phase of the ramp.

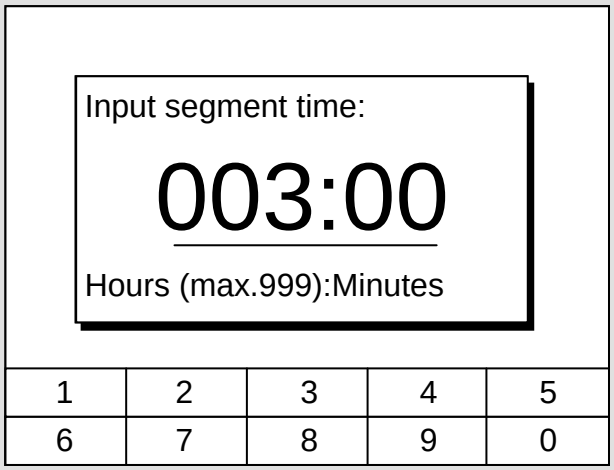
Nr.	Pumpe	Out 1	Out 2	Out 3
Start	-------	-------	-------	-------
1	4	-------	-------	-------

Pump	Menu	End	Insert	Delete

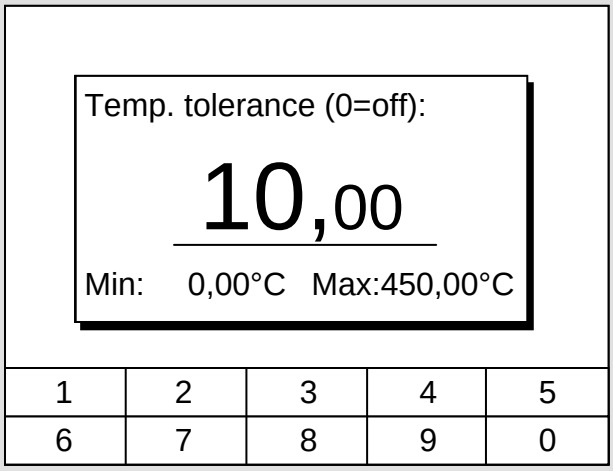
- Then continue with to the pump and signal output setting.
- The right-hand part of the entry table appears as shown on the left.
- Here, in the "Pump" field, the pump level and, in the fields "Out 1" to "Out 3", the contact outputs of the contact mode (accessory) can be programmed. With the setting "-------" the starting value is retained which was either set before the program start or was defined by a previous segment in the running program. Further details are given on the following pages.



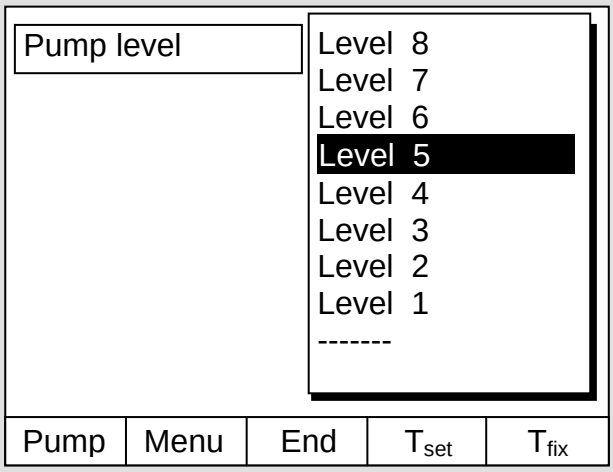
- A new segment is produced by moving the cell with the black background to a blank line with the cursor keys and then pressing the soft key Insert. The values of the cell located above it are automatically copied.
- If the field in the column **T end °C** has a black background, the entry mode "End of segment temperature" is obtained by pressing the ↵ key. Depending on the setting, that is the temperature which the thermostat is to achieve on the internal or external temperature probe.
- Enter the value, confirm with the ↵ key and continue to the "Time" entry field with →.

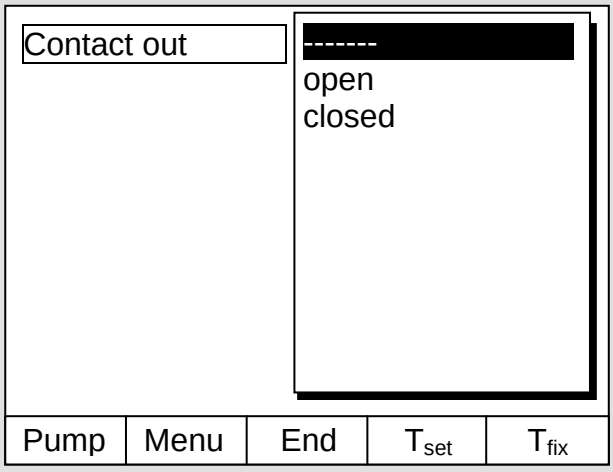


- If the field in the column **Time** has a black background, the entry mode for the "Segment time" time setting is obtained by pressing the ↵ key.
- If 0 is entered into the field "Time", ------ appears. Then the final temperature is approached as quickly as possible. With a time entry the final temperature is obtained exactly after the time expires (ramp).
- Enter the segment time and confirm with the ↵ key.
- Continue to the "Tolerance" entry field with →.



- If the field in the column "Tolerance" has a black background, the entry mode for the "Temperature tolerance" is obtained by pressing the ↵ key. It defines how accurately the end of segment temperature is to be obtained before the next segment is processed.
  A tolerance which is selected too small can stop the next segment from being started according to plan.
- Set the temperature tolerance and confirm with ↵.
- Continue with → to the entry field "Pump".

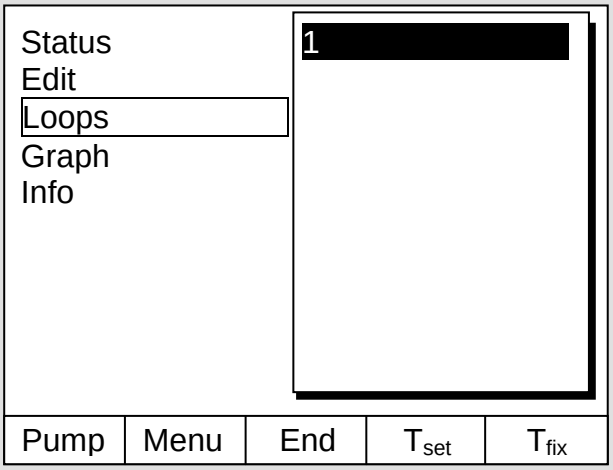




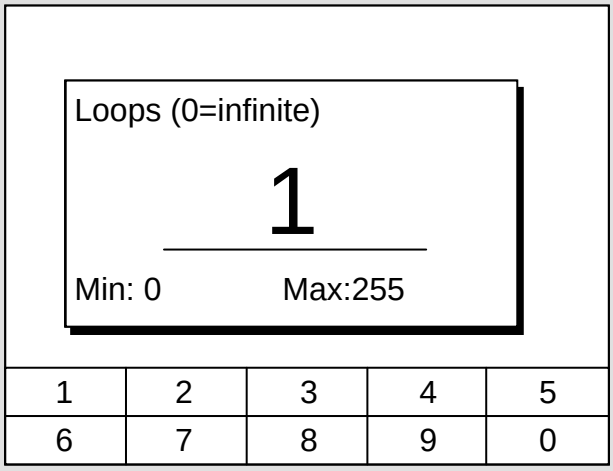
- If the field in the column "Pump" has a black background, the entry mode for the Pump level is obtained by pressing the key ↵.
- With ↓ or ↑ select Pump Level 1 – 8 or ------- and confirm with ↵.
  ------ stands for "no change to previous segment", i.e. when ------ is present in all fields, the pump level always retains the start setting or the setting before the program start.
- Continue with → to the field “Out 1", “Out 2" or “Out 3".
- The contact outputs of the contact module (if present, special accessory) are programmed here.
- If the field in the column "Out1" has a black background, then access to the entry mode for the Contact output is obtained by pressing the key ↵.
- Select -------, open or closed with ↓ or ↑ and confirm with ↵.
  ------- stands for no change to the previous segment, i.e. if ------- is present in all fields, the contact setting of the start setting or of that before the program start is always retained.
- If applicable, continue to "Out 2" und "Out 3" with →.
- Programming is terminated with esc or End .

7.12.5 Defining the number of program loops (Loops)

Command | Programmer | Program1 | Loops



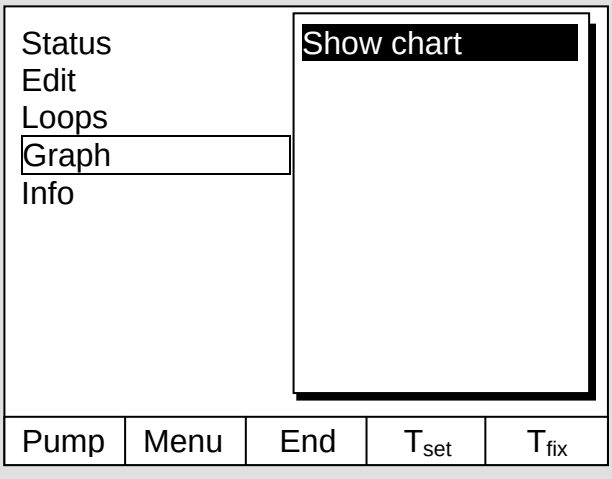
- If required, programs can be looped many times.
- With ↓ and → access the menu Loops .
- Select the number of desired program loops.



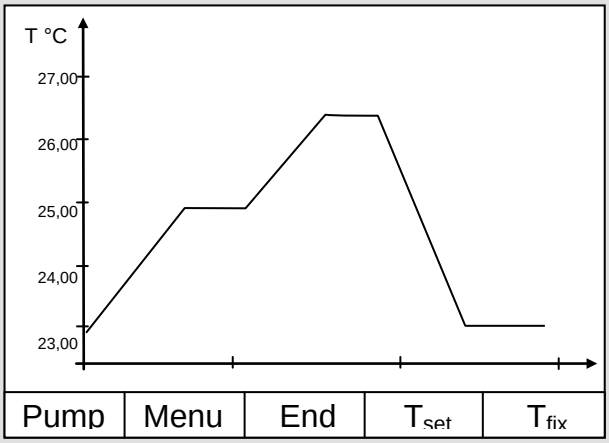
- Press the ↵ key, set the required number. Entering 0 causes the program to repeat continuously.
- Confirm the entry with the ↵ key and return to the display.
- You can quit the Edit mode with esc or End .

7.12.6 Viewing the program sequence as a graph (Graph)

Command | Programmer | Program1 | Graph



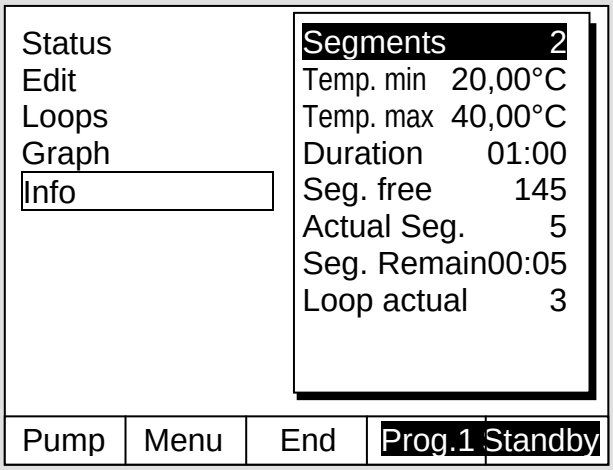
- ↓ takes you to the submenu Graph .
- Press the → key à Show chart press ↵.
- The program sequence is shown.



- The display of the programmed temperature curve can be quit with esc or End.

7.12.7 Obtaining information on a program (Info)

Command Programmer Program1 Info



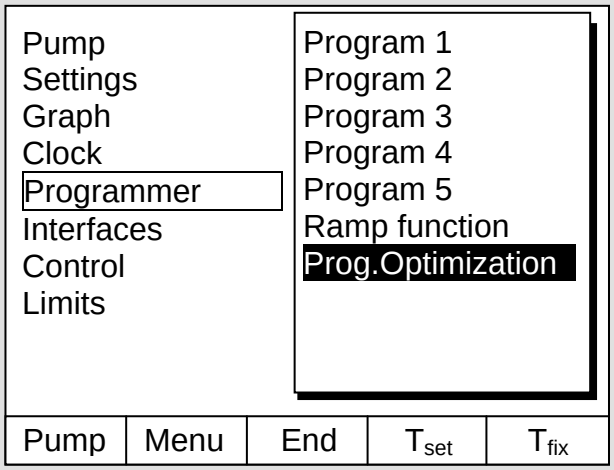
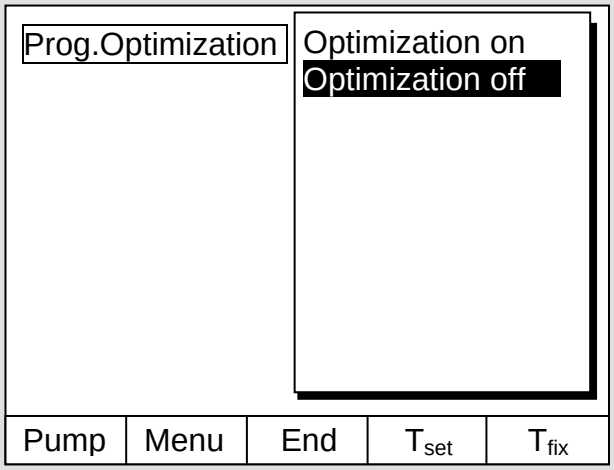
- Continue with ↓ to Info .
- Here, all information is displayed about the entered program sequence.
- Number of segments.
- Minimum temperature in °C.
- Maximum temperature in °C.
- Program duration in hh:mm without the time which is necessary to process step changes in temperature.
- Number of free segments.
- Segment which is at present (currently) being processed.
- Residual time of the current segment in hours and minutes.
- Current pass; in the example the third of all passes is running.

The last three points are only displayed when a program runs.

- Quit the window with esc or End .

7.12.8 Optimization of the Programmer

The menu item “Optimizing the programmer” in practice leads to a very good control behavior.

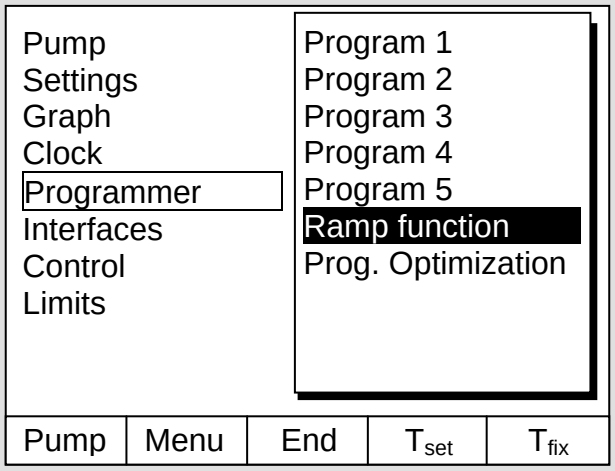
Command	Prog. Optimization
	- Open the device parameter menu via the soft key Menu . - With the cursor keys continue to: à Programmer à Prog. Optimization. - Conform with key ↵.
	In this submenu you are able to switch on/off the program optimization. In diesem Untermenü wird die Programmoptimierung ein- und ausgeschaltet.

7.13 Ramp function

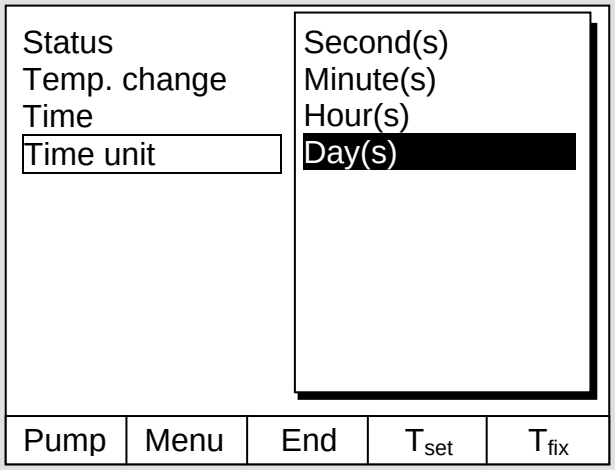
With the ramp function temperature changes over any time period can be conveniently entered. This is especially advantageous with very low temperature changes (e.g. 0.1 °C/day).
Example: From the current outflow temperature (e.g. 242.4 °C) 200 °C of cooling is to occur over 5 days. Then the temperature change is entered as 200 °C and the time as 5 days.

The ramp function is executed until it is manually terminated or until the temperature limits T_{il} (min) or T_{ih} (max) described in Section 7.10.2 are attained.

Command	Ramp function



- Open the list of device parameters using the soft key Menu.
- With the cursor keys continue to: à Programmer à Ramp function.
- Confirm with the key ↵.

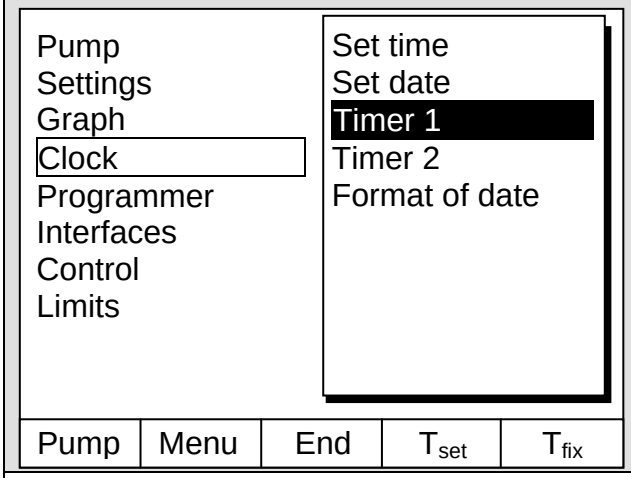


- Enter a positive or negative temperature value with Temp. change.
- With Time enter a figure (without time unit).
- With Time unit choose between Second(s) up to Day(s).
- Under Status the ramp is started à Start or stopped à Stop.
- When the ramp function is being executed, Ramp active appears in the window bar.
- Without manual switch-off the ramp terminates at the latest at T_{il} (min) or T_{ih} (max).

7.14 Timer function / Timer (Command)

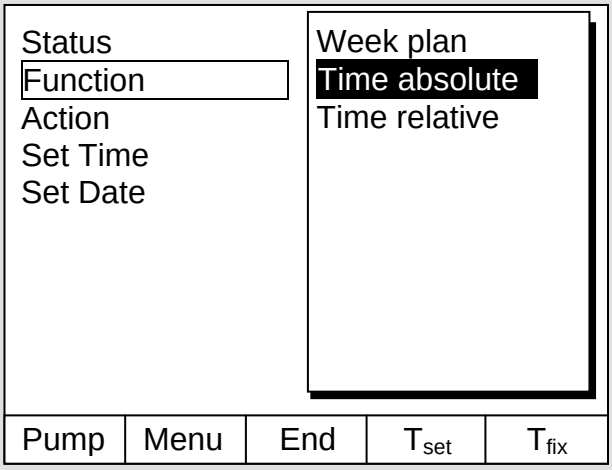
Using the timer function, the thermostat can carry out an action at a certain time or after a certain waiting period. Actions are: Switching on the thermostat, entering the standby mode or one of the 5 programs in the programmer.

Command | Clock | Timer 1 | Timer 2



- Open the device parameter menu via the soft key Menu.
- With the cursor keys continue to: à Clock à Timer 1,
- or to Timer 2,
- with the menu Status the selected timer is switched off or on .
- The standby key does not stop the timer.

Please exercise caution when the thermostat is in standby mode. The thermostat is not switched off absolutely safely.
A previously activated timer mode could unintentionally start the thermostat again from the standby mode!



The menu Function is used to define **when** an action is executed:

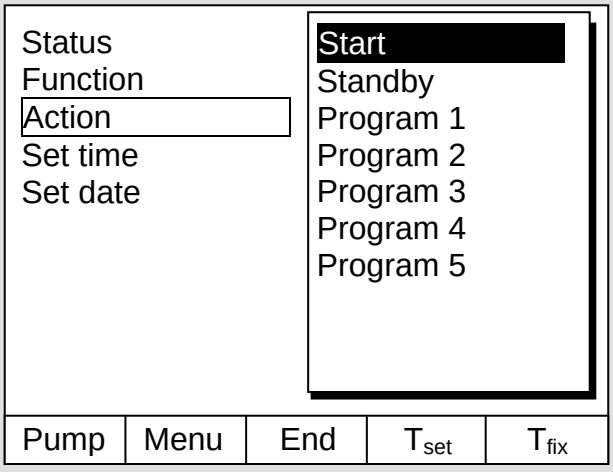
- Similar to an electronic mains timer, Week plan enables two switching events to be carried out each day. The cycle is repeated after 7 days.
- Time absolute defines a time and a date on which a once-only action (switching event) occurs. The time point is set with Set time and with Set date.
- Time relative defines a waiting period after which a once-only action occurs. With Set time up to 99h59min can be entered. ("Set date" is masked out with this function selection.)
- If the Week plan is activated, in this window only Status , Function and Week plan are displayed.

Week plan				
	Time	Action	Time	Action
Monday	07:30	Start	17:00	-------
Tuesday	10:00	Prog.4	17:00	-------
Wednesday	08:00	-------	17:00	-------
Thursday	08:00	-------	17:00	-------
Friday	08:00	-------	16:00	Standby
Saturday	08:00	-------	17:00	-------
Sunday	08:00	-------	17:00	-------

Pump	Menu	End	T_{set}	T_{fix}

- Week plan à Arrange takes you to the window shown on the left.
- Using the cursor keys ↑, → select the field which is to be filled in.
- Open the input dialog of the field with ↵: Select a time in the time fields and an action in the action field.
- In the example on the right the thermostat is started on Monday at 7:30h, Program 4 is executed at 10:00h on Tuesday and the standby mode is switched in on Friday at 16:00h. Fields displaying "------" are passive.

Confirm each field selection with ↵ or quit with esc without making changes.



The menu Action is used to define **what** is to be carried out:

- Start activates the thermostat from the standby mode.
- Standby activates the standby mode (refrigerating unit, heater and pump are switched off).
- Program X all actions of this program defined in the programmer are processed.

7.15 Control and Control parameters

The control parameters are optimized ex-works for operation as a process thermostat. The parameters are also preset for the operation with external control. Sometimes however, the operation of external containers requires adaptation. Also the thermal capacity and viscosity of the heat transfer liquid sometimes require adaptation.

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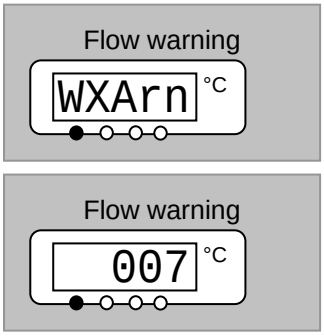
- The intelligent menu guidance with the Master and Command detects whether you have set the device (as described in Section 7.9.6), to internal or external control and only displays the relevant dialog boxes in each case.
- Some control parameters are automatically optimized by your Integral XT process thermostat. This automatic mechanism should only be deactivated and manually optimized in exceptional cases.

In order to obtain good control characteristics, the hydraulic system should provide the best possible coupling of the object to be temperature stabilized to the thermostatic device. The following should be fulfilled in this respect:

- Low viscosity heat transfer liquids: e.g. thin-bodied oil, water-glycol.
- Short hose connections with a large cross-section.
  The flow resistance is then low and a large amount of thermostatic medium can be pumped in a short time. In addition, the circulation time is short.
- Select a sufficiently high pump level (pump pressure):

LAUDA device	Pump level
XT 150	2...6
XT 750	4...8

- Observe the return temperature (an external return temperature sensor can be connected via the analog interface, accessory): During the heating up phase (100 % heating power) the difference temperature Outflow - Return temperature should less than 5…7°K.



- If the flow through the hydraulic circuit is too low, then on heating up the warning WXArn 332 or on cooling the warning WXArn 007 is triggered.
- An adjustable bypass can be connected to prevent these warnings. The bypass ensures that the flow in the thermostat is maintained such that the controller can operate properly. More measures (þ 9.4).

7.15.1 Setting instructions for bypass

When the warnings described in the previous section appear, a bypass can be connected which passes a partial flow from the thermostat output directly to the input. Set the optimum bypass flow as follows:

- Depending on the pump level according to the table, reduce the pressure by opening the bypass. The specified values should also be sufficient if no flow was previously present. If the pressure with the bypass is too low, close the bypass slightly. If warnings occur, the bypass must be opened further again.

Pump level	1	2	3	4	5	6	7	8
Pressure reduction	0.25	0.3	0.35	0.4	0.45	0.5	0.5	0.5

- Keep this setting also with a changed pump level or also with pressure control.

7.15.2 Configuration examples

Example 1, favorable configuration:

- LAUDA Integral XT 750 with connected metal double-shell vessel (20 L),
- 2 x 2 m metal corrugated hose, 20 mm clearance (M30 x 1.5),
- no by-pass,
- oil LAUDA Kryo 55, in temperature range -50...220 °C,
- pump on Level 6.

Example 2, unfavorable configuration:

- LAUDA Integral XT 150 with connected glass double-shell vessel (5 L),
- 2 x **4 m** metal corrugated hose, **10 mm** clearance,
- no by-pass,
- oil LAUDA Kryo 55, in temperature range -50...220 °C,
- pump set to pressure control at 1 bar.

On account of the too little flow, caused by the low pressure (1 bar) and the unfavorable hose arrangement (8 m length with only 10 mm clearance), the warning messages WXArn 007 and WXArn 332 are triggered. The control is unstable and only very slow in response.

Example 2, improved configuration:

- Metal corrugated hose shortened to 2 x **3m**, but 10mm clearance could not be enlarged,
- with by-pass, see above for setting,
- pump increase to pressure control at **1.3 bar**.

Flow was better and therefore no more warning messages. Also the control can be adjusted better, but a larger clearance in the hoses is more effective for optimum operation.

7.15.3 Internal control variable (integral measurement probe)

Only read further here if you have no external temperature probe connected (and activated according to Section 7.9.6 as control variable).
The outflow controller compares the setpoint temperature with the outflow temperature and computes the actuating signal, i.e. the measure used for heating or cooling.

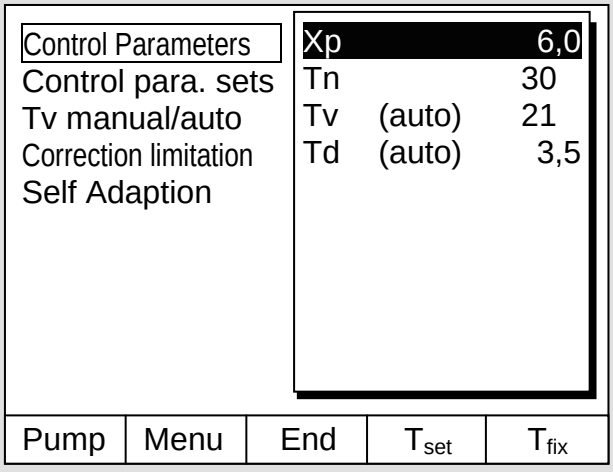
These parameters can be set on the outflow controller:

If "Tv manual/auto" is set to "automatic", Tv and Td cannot be changed. They are in this case derived from Tn with fixed factors.

Description	Short form	Unit
Proportional range	Xp	K
Reset time	Tn	s
Derivative time	Tv	s
Damping	Td	s

In addition the following parameters can affect the control:
Temperature limits: Tih, Til (þ 7.10.2),
Actuating signal limit: Heating, cooling (þ 7.15.7.1).

Command — Control Parameters



- Open the device parameter menu via the soft key Menu.
- With the cursor keys continue to: à Control à Control Parameters à Control Parameters.
- The adjacent window appears.
- Change parameters marked with (auto) where necessary to manual input with Tv manual/auto.
- Select the parameters to be changed with and confirm with .
- Then in the following settings window, change the value and confirm with .

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- The viscosity of the heat transfer liquids changes substantially with the temperature. At low temperatures the liquids are highly viscous. The control quality is therefore generally worse at low temperatures.
- The controller should therefore be set close to the lowest temperature of the temperature range to be covered.
- If the control at low temperatures is stable, then generally it is also stable at high temperatures.
- If, vice versa, a system is just stable at high temperatures, then it is highly probable that it is unstable at low temperatures, i.e. it oscillates.
- If the operating temperature range of a system is for example -20...150 °C, then the controller setting should be carried out at approx. -10...20 °C.

7.15.3.1 Procedure for setting the control parameters for internal control

1. Choose a set of control parameters from the table of control parameters (þ 7.15.3.2).
2. Adjust the setpoint by 5 °C (5 K setpoint step change) and record the outflow temperature for at least 5 minutes.
3. If the outflow temperature oscillates (>0.1 K), then enlarge Xp until the oscillation dies away. Always wait a number of minutes between the changes.
4. +20 K setpoint step change, await transient response,
   -20 K setpoint step change, await transient response.
5. Assess transient responses:
   - if an overshoot is to be reduced, then slowly increase Tv (until about 90 % of Tn),
   - if settling is too slow, then reduce Tv to about 60 % of Tn,
   - always adjust Td: Td = 20 % of Tv,
   - after each change repeat Point 4. Carry out and evaluate ±20 K setpoint step changes.
6. If the response takes too long, then Tn can be reduced. Similarly reduce Tv, Td as a percentage. Reduce Xp to 70...50 % so that the system oscillates. Then continue from Point 2.
7. If the tendency to oscillate increases without the overshoot being acceptably reduced, then
   a) Xp can be slightly increased; continue with Point 3,
   b) larger time constants should be chosen: Increase Tn, Tv, Td by 30...80 %,
   and Xp to 70...50 % so that the system oscillates. Then continue from Point 2.

7.15.3.2 Table with control parameters and pump level for internal control

Outflow control Device type	Heat transfer liquid in the outflow	External application	Xp _P	Tn tn	Tv tu	Td td	Pump level
XT 150, XT 250 W	KRYO 30	a)	30	80	68	15	6
	KRYO 30	b)	40	100	84	18	4
	KRYO 55	c)	30	50	40	8	3
XT 750 H, XT 950 W	KRYO 55	d)	50	50	40	8	8
	KRYO 55	e)	80	100	85	16	5

Description

a)	20 m pipe, D = 10 mm (internal), bypass used.
b)	20 m pipe, D = 10 mm (internal), bypass used.
c)	Glass double-shell reactor with 4 liters, uninsulated, thermostatic oil in the reactor, 2 x 1.5 m metal corrugated hose D = 10 mm (internal).
d)	Metal double-shell reactor, 17 liters of thermostatic oil in the reactor, 2 x 1.5 m metal corrugated hose D = 20 mm
e)	Glass double-shell reactor with 4 liters, uninsulated, thermostatic oil in the reactor, 2 x 5 m metal corrugated hose D = 10 mm (internal), bypass used.

7.15.4 External control variable (External measurement probe)

You only need to read further here if you have connected an external temperature probe or the actual temperature is read in from a module (and you have activated it as control variable according to Section 7.9.6).

Only modify the control parameters if you have knowledge of control techniques.
The control system for external actual values is implemented for improvement of the control behavior as a two-stage cascade controller.
From the temperature setpoint and the external temperature, which is generally measured by the external Pt100, a "master controller" determines the "internal setpoint" passed to the slave controller.
The control value of the slave controller controls the heating and cooling.
When a setpoint step change is specified, it may be that the optimum control would set an outflow temperature which might significantly exceed the temperature desired on the external vessel.
There is a correction limitation which specifies the maximum permissible deviation between the temperature on the external load and the temperature of the outflow liquid.

These parameters can be set on the master controller ($PIDT_1$ controller or external controller):

Description	Short form	Unit
Gain	Kpe	-
Proportional range	Prop_E	K
Reset time	Tne	s
Derivative time	Tve	s
Damping time	Tde	s

These parameters can be set on the slave controller (P controller):

If “Tv manual/auto” is set to automatic, Tve, Tde and Prop_E cannot be changed. Tve and Tde are in this case derived from Tne with fixed factors.

Description	Short form	Unit
Proportional range	Xpf	K

In addition the following parameters can affect the control:
Temperature limits: T_{il}, T_{ih} (þ 7.10.2).
Actuating signal limit: Heating, cooling (þ 7.15.7).
Correction limitation.

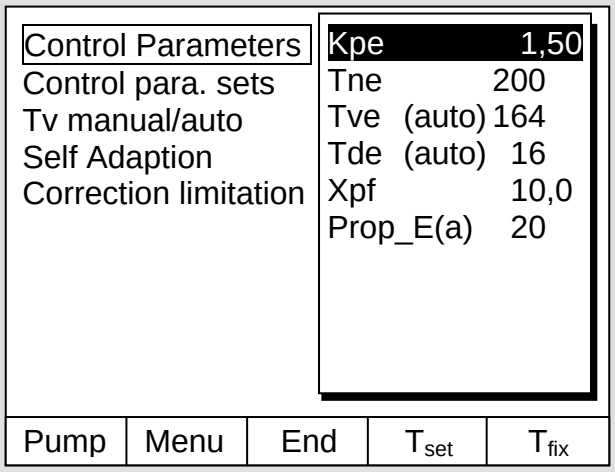
Set the temperature limits (T_{il} / T_{ih}) corresponding to the physical boundary conditions; examples:

Heat transfer liquid	**Correction limitation**	**T_{il}**	**T_{ih}**
Kryo 55	Depends on heat transfer liquid and on load.	-50 °C	220 °C
Kryo 30		-30 °C	90 °C

à Aids in viewing the temporal progression:

- Graphic mode on the Command remote control,
- LAUDA Wintherm PC Program.

Command	Control Parameters



- Open the device parameter menu via the soft key Menu .
- With the cursor keys continue to: à Control à Control Parameters à Control Parameters.
- The adjacent window appears. Parameter endings: e = Master controller, f = Slave controller.
- Where applicable change parameters marked with (auto) to manual input with Tv manual/auto .
- Select the parameters to be changed with and confirm with .
- Then change the value in the following settings window and confirm with .
- Correction limitation see introduction (þ 7.15.4).

7.15.4.1 Procedure for setting the control parameters for external control

First of all select a set of control parameters from the table in Section 7.15.4.2. Wait until the product temperature in the external vessel has approached to within at least ±3 K and the outflow temperature no longer increases or no longer falls. Oscillation of the outflow temperature does not matter yet.

A) Set slave controller (internal controller):

Tests have shown that a pure P controller is perfectly sufficient as a slave controller.

1. Set the master controller to "idle"; to do this set Kpe to 0.1. The master controller now operates only very weakly.
2. If the outflow temperature oscillates > ±0.1 K, then continue with Point 3.

2a. Reduce Xpf until the outflow temperature oscillates (> ±0.1 K).

3. Slowly increase Xpf until the oscillation dies away. Increase Xpf further by about 20 % (safety margin).

4. If Xpf < 10..... è good outflow control circuit/hydraulics.
   If Xpf 10...15 è average outflow control circuit/hydraulics.
   If Xpf > 15 è poor outflow control circuit/hydraulics.

If the outflow control circuit (hydraulics) is of poor quality, then the quality of the external controller is also detrimentally affected.

B) Setting the master controller (external controller):

Experience has shown that the setting of the master controller demands much more time than the setting of the internal controller for a pure outflow temperature control. Many days may be necessary for a difficult control circuit.

1. Alter the setpoint by 5 °C (5 K setpoint step change) and record the outflow temperature and the external temperature for a sufficient length of time (approx. 20-40 min).
2. If the external temperature oscillates (> 0.1 K), then reduce Kpe until the oscillation dies away. Always wait a sufficient length of time between the changes (at least 2 oscillation periods).
3. +20 K setpoint step change, await transient response;
   -20 K setpoint step change, await transient response.
4. Assess transient responses:
   – if an overshoot is to be reduced, then slowly increase Tve (until about 90 % of Tne),
   – vice versa, reduce Tve to about 60 % of Tne,
   – in doing this, adjust Tde. Tde = 20 % of Tve,
   – continue at 3) after each change: Carry out and evaluate ±20 K setpoint step changes.
5. If the response takes too long, then Tne can be reduced. Similarly reduce Tve, Tde as a percentage. Reduce Kpe to 150...200 % so that the system oscillates. Then continue from Point 2.
6. If the tendency to oscillate increases without the overshoot being acceptably reduced,
   a) Kpe can be slightly reduced; continue with Point 3,
   b) is a larger time constant need to be chosen: Kpe to 150..200 % so that the system oscillates. Then continue from Point 2.

7.15.4.2 Well-proven settings for control parameters and pump level for external control

			Master controller (external controller)					Slave controller (internal controller)		
Type of device	**Heat transfer liquid**	**External application**	Kpe EP	Tne En	Tve Eu	Tde Ed	Prop_E Eb	Xpf iP	**Pump level**	**Press. control**
XT 150, XT 250 W	KRYO 55	a)	4.0	300	246	24.0	20	5.0	3	--
	KRYO 55	b)	1.5	300	246	24.0	20	7.0	1	1bar
	KRYO 55	c)	0.7	100	84	8.0	20	7.0	4	--
XT 750 H, XT 950 W	KRYO 55	d)	1.5	200	164	16.0	20	5.0	8	--
	KRYO 55	e)	1.5	300	246	24.0	20	15.0	5	--
	KRYO 55	f)	0.4	70	61	7.0	20	12.0	6	--

Description

a)	Glass double-shell reactor with 4 liters, uninsulated, thermostatic oil in the reactor, 2 x 1.5 m metal corrugated hose D = 10 mm (internal).
b)	Glass double-shell reactor with 4 liters, uninsulated, thermostatic oil in the reactor, 2 x 6 m metal corrugated hose D = 10 mm (internal), pressure control to P = 1 bar, bypass used.
c)	Load with low volume, low thermal capacity, low flow (cross-sections < 10 mm).
d)	Metal double-shell reactor, 17 liters of thermostatic oil in the reactor, 2 x 1.5 m metal corrugated hose D = 20 mm
e)	Glass double-shell reactor with 4 liters, uninsulated, thermostatic oil in the reactor, 2 x 5 m metal corrugated hose D = 10 mm (internal), bypass used.
f)	Load with low volume, low thermal capacity, low flow (cross-sections < 10 mm), bypass used.

7.15.5 Internal and external control parameter sets

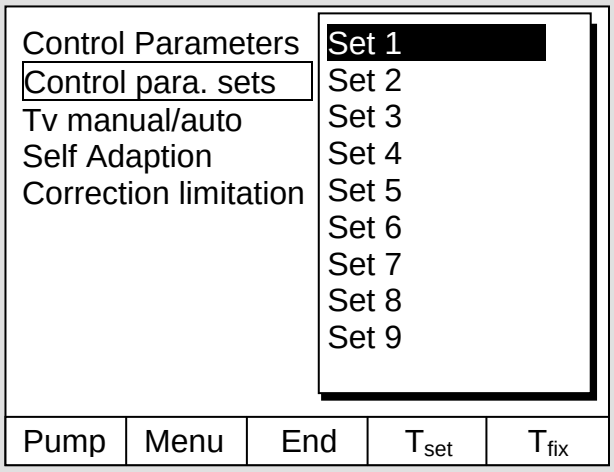
If a thermostat is used for a number of applications, which always leads to a change of the control parameters, these control parameters (up to 9 sets) can be saved in the thermostat and activated again as required.

Also saving is useful for finding the best control parameters; in this way external management of the control parameters can be avoided.

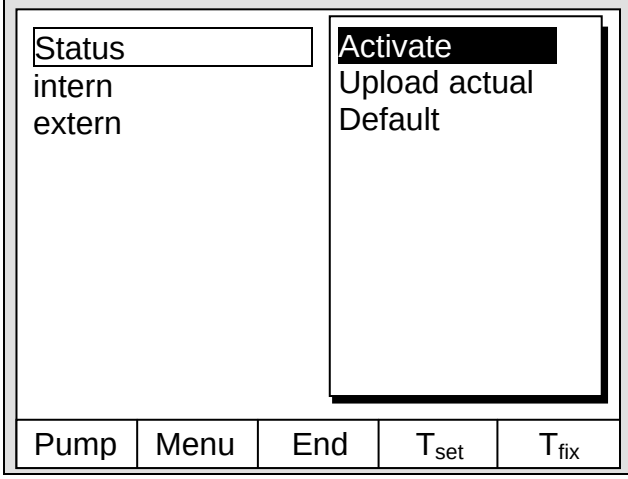
There are 9 sets (each for internal and external sets of control parameters) saved at the factory.
In this menu the control parameters cannot be edited, they are only displayed.

- With Activate the currently valid control parameters are used.
- With Upload actual the actual ones are read in and saved (for later reuse).
- With Default the set of control parameters saved at the works is loaded again (in this case the control parameters set by the customer are lost).

Command	Control parameter sets



- Open the device parameter menu via the soft key Menu.
- With the cursor keys continue to: à Control à Control Parameters à Control para. sets.
- The adjacent window appears. Set 1 to Set 9.
- Select the desired set with and confirm with .
- Select the desired set to be changed with and confirm with .



- In the setting window (see left) the selected set is listed under internal or external in the display.
- Under Status the previously selected set:
  is activated,
  is read in and
  the set, which was saved at the factory, is restored.

Editing the control parameter sets

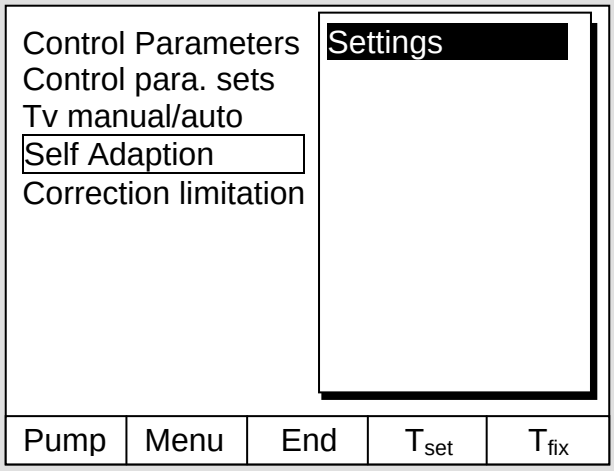
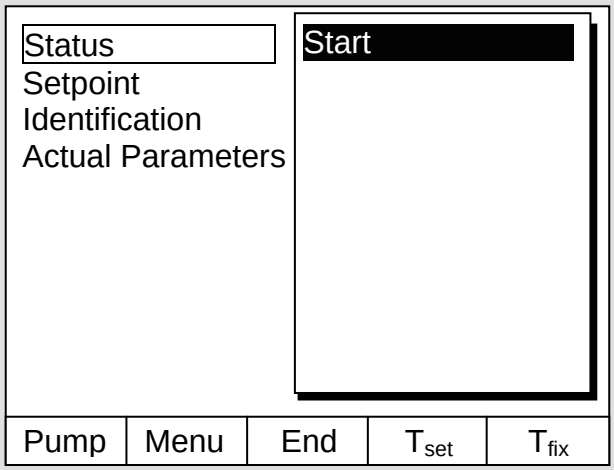
The change in the control parameters is explained in Section 7.15.3 / 7.15.4 (internal / external). Once the value has been changed and confirmed, the set number, e.g. Set 3 and Upload actual, the new value is accepted into the control parameter set to be changed (Set 3) via the command Control parameter sets.

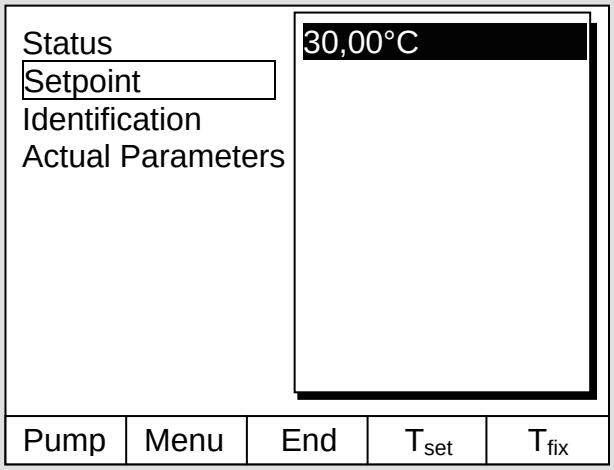
7.15.6 Self Adaption

The function Self Adaption can be used to detect automatically the optimal control parameters for internal or external control.
The self adaption will begin only on devices with active cooling.

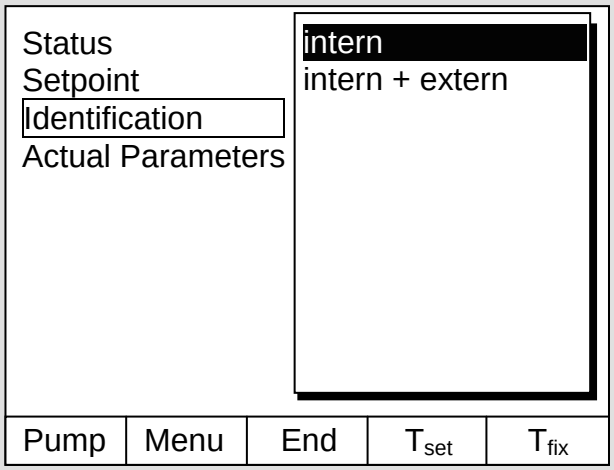
This function is available from software version 2.18 of Command. For thermostats with an older software version a software update is necessary.

The Self Adaption determines the parameters by a test run of the thermostat. In this case the thermostat and, if applicable, the external application must be ready for operation. (þ 6).
The Self Adaption will be performed with the actually set pump step. Best results can be achieved with high pump steps.
The test run must be performed at a passive system; this means that during the test run an exo- or endotherrmic reaction mustn't take place.
The test run takes depending on the external application about 30 minutes to 3 hours. The bath temperature will oscillate in this time less than about ±15 Kelvin around the set temperature. After the test run the detected control parameters will be taken over as control parameters automatically.

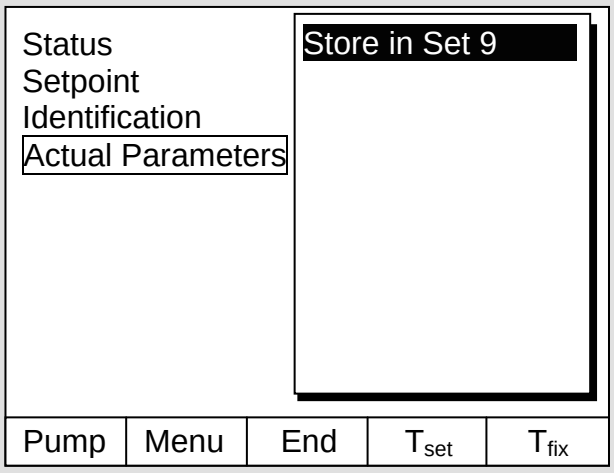
Command	Self Adaption
	- Open the device parameter menu via the soft key Menu. - With the cursor keys continue to: à Control à Control Parameters à Self Adaption à Settings. - Confirm selection with ↵.
	- The window shown adjacent appears. - With the menu Status the test run of the Self Adaption can be started. When the Self Adaption is finished, the test run will be terminated automatically. - As soon as start ↵ is pressed, in the sofkey area the information Adaption on will be displayed followed by the actual status of the test run.



- With the menu **Setpoint** the set temperature for the test run can be set. The bath temperature will oscillate less than about ±15 Kelvin around the set temperature.
- Change the display in the adjacent window and accept with ↵.



- With the menu **Identification** the optimal control parameters for internal control or for the internal control and the external control can be detected automatically.
  To detect the control parameters for the external application, a temperature probe must be connected to the thermostat.

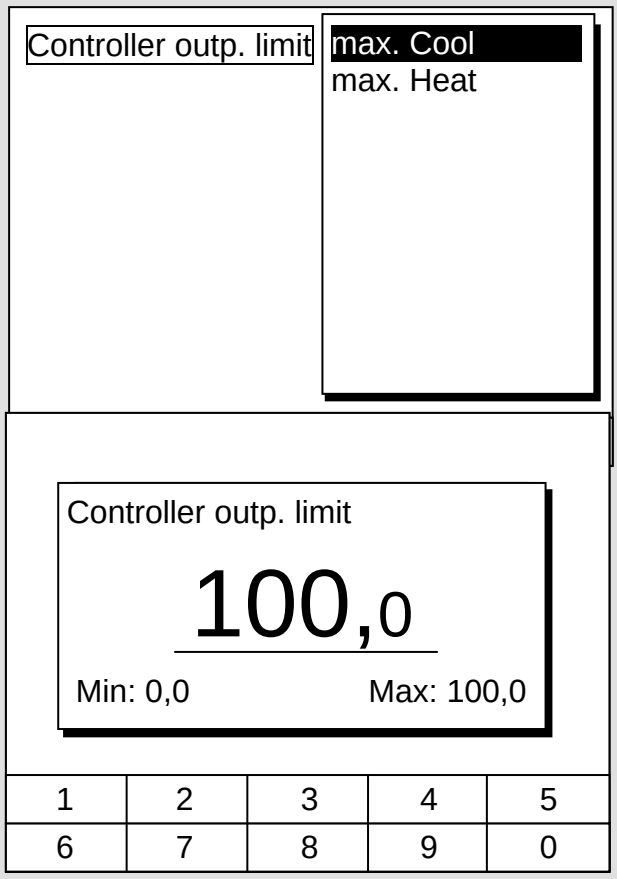


- With the menu **Actual Parameters** the actual set control parameters can be stored in parameter set 9.
  After the test run the detected control parameters will be taken over as control parameters automatically. If the parameters found do not fulfil your expectations, the before set parameters can be restored (þ 7.15.5).

7.15.7 Limiting the heating and cooling power

7.15.7.1 Actuating signal limit

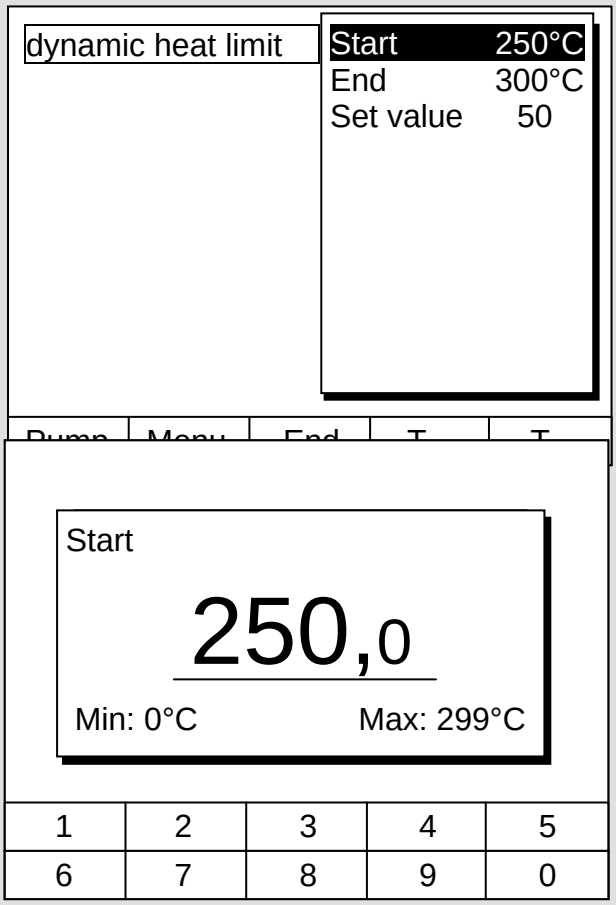
With the actuating signal limit the maximum heating and / or cooling power can be limited. The setting occurs in percent of the maximum value.

Command	Controller output limit
	- Open the device parameter menu with the softkey Menu. - With the cursor keys continue to: change à Control à Controller outp. limit. - The adjacent window appears. Select max. Cool or max. Heat with the cursor key and confirm with ↵. - Enter the desired percentage. - Accept the change with ↵, - or quit the window with esc without making any changes.
+ In addition, the cooling unit can be completely switched off via the operating menu à Interfaces à Smart Cool.	

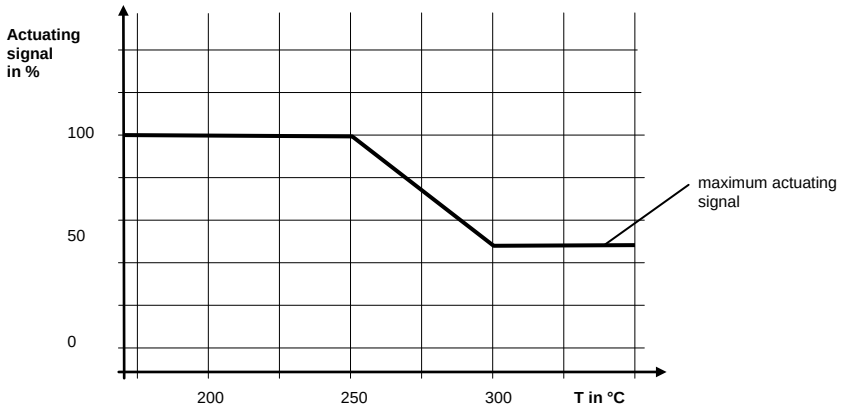
7.15.7.2 Dynamic limitation of heating power

With the dynamic heating power limitation the heating power can be limited to protect the heat transfer liquid from overheating on the heater. See also (þ 7.15.7.3).

Command	dynamic heat limit



- Open the device parameter menu with the softkey Menu.
- With the cursor keys continue to: Change à Control à dynamic heat limit.
- The window shown adjacent appears. Select with the cursor key Start, End or Set value and confirm with ↵.
- Enter the required limit temperature.
- Accept the change with ↵,
- or quit the window with ESC without making any changes.



Example:

Start = 250 °C
End = 300 °C
Actuating signal = 50 %

7.15.7.3 Dynamic control of heating power

With insufficient flow rates at the heaters there is a risk that the heat transfer liquid is locally overheated. This may lead to earlier aging, oil cracking at silicone oils (depolymerisation) or bubbling up. At small pump levels the heating power is regulated automatically by the dynamic heating power control. Generally up from pump level 5 the maximum heater capacity is available at all devices.
This function can not be adjusted or disabled.

7.16 Alarms, Warnings and Errors

The SelfCheck Assistant of your Integral XT Thermostat monitors more than 50 device parameters and triggers alarms, warnings or errors as appropriate.
All warnings, alarms and errors are shown on the Command remote control in plain text. Errors are shown in plain text on the Command remote control in an error list.

Alarms: Alarms are safety relevant. Pump, heater and refrigerating unit will be shut off.

Warnings: Warnings normally are not safety relevant. The device continues to operate.

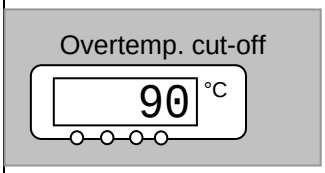
Error: If a fault occurs, the pump, heater and cooling unit switch off automatically. Switch off the device at the mains switch. If the fault recurs after switching on the device, please contact the LAUDA Service Constant Temperature Equipment (þ 9.5).

Find cause of alarm or warning and rectify where necessary. Then press on the Master keyboard in order to remove the alarm message. Warning messages can be removed either on the Master keyboard with or on the Command board with .

Warnings may be ignored by pressing or on the Master keyboard or by activating the Screen Softkey on the Command remote control. Otherwise warnings will be repeated periodically.

7.16.1 Overtemperature protection and checking

+ The units are designed for operation with non-flammable and flammable liquids to DIN EN 61010-2-010.



Setting the overtemperature cut-off: Recommended setting: 5°C above desired bath temperature.

Caution!! The overheat switch-off point T_{max} is controlled by a system functioning independently of the bath control. Setting of the nominal temperature, however, can be limited via the functions T_{ih} and T_{il} (þ 7.10.2) independently of T_{max}.

- The cut-off point is displayed in the LED display on pressing the key .

Changing the overtemperature cut-off point:

- For safety, to guard against unintentional adjustment, the key must be held pressed during all the following entries. Now, briefly press . The display flashes and the overtemperature cut-off can be set with the keys or .
- Quit the change mode by pressing for a few seconds or automatically after 5 seconds, while you keep pressed.
- This somewhat complicated procedure is intended to prevent unintentional adjustment.

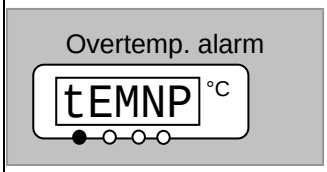
+

- Not higher than 25 °C below the fire point of the heat transfer liquid used (þ 6.2).
- The setting range is restricted to 5 °C above the upper limit of the working temperature range (Tih þ 7.10.2).

%‰

- If the outflow temperature rises above the overtemperature cut-off:

1. Alarm sounds as dual-tone signal.



2. tEMNP for overtemperature appears in the display.
3. The red LED ☼ above the fault triangle ⚠ flashes.
   à Heater switches off on both poles;
   à Pump and refrigerating unit are switched off electronically.

- Rectify cause of fault (þ 9.4).

- Unlock with the ↵ key.
- Unlocking is not possible on the Command remote control!

+

- Before longer periods of unsupervised operation, the **overtemperature protection should be checked. To do this:**

- slowly lower T_{max}, as described above.
  à Cut-off at the outflow temperature should occur.
- Step 1 – 2 (see above) must follow.
- Set the overtemperature cut-off higher than the outflow temperature again and wait until tEMNP appears in the display.

- Unlock with the ↵ key.

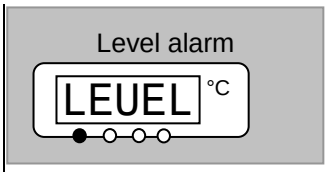
Unlocking is not possible on the Command remote control!

Command	Overtemperature alarm!
⚠	- Overtemperature alarm! is shown in the display and signifies that unlocking is only possible on the Master control panel.

7.16.2 Low-level alarm and low-level checking

Various levels (þ 7.5).

	Low level warning: With the Integral XT the warning is activated at Liquid Level 1, then the operator should top up (also possible in running operation) and check why less medium is present (cooling, degassing or leakage?) (þ 9.4).
%‰	If the liquid level in the expansion vessel continues to fall (Level 0), an alarm is triggered. 1. The alarm sounds as a dual-tone signal.



2. Display for LEUEL (low level) is shown when the expansion vessel contains too little liquid.
3. The red LED ☼ above the fault triangle ⚠ flashes.
   à Heater switches off on both poles;
   à Pump and refrigerating unit are switched off electronically.

- Rectify cause of fault (þ 9.4).
- Press the enter key.
- Also press this key if the unit has been switched off in the fault state.

+

- **Checking the safety system at regular intervals** by lowering the expansion vessel level. For that purpose do **not** use the draining program.
- Step 1 – 2 (see above) must follow.

- With this test the outflow temperature must not be below 0 °C or above max. 50 °C, otherwise there is a risk of burning! Besides which, the device can be damaged.
- If irregularities arise during the checking of the safety devices, switch off the unit immediately and pull out the mains plug.
- Have the equipment checked by LAUDA Service.

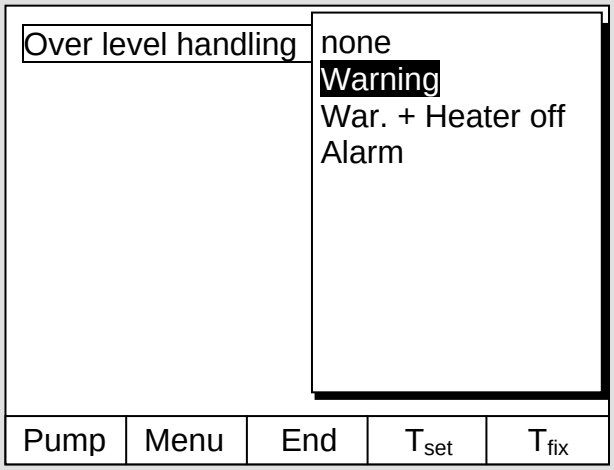
Command	Low-level alarm!

- Low-level alarm is shown in the display and signifies that unlocking is only possible on the Master control panel.

7.16.3 High-level settings

Different reactions can be chosen when the level sensor detects the height of the bath liquid level. Depending on the setup, heat transfer liquid or operation conditions, one of the following settings may be suitable:

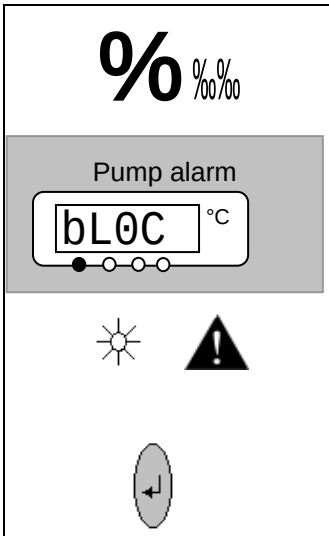
Setting	Command settings	Reaction and application recommendation
No warning	none	Select only when no safety sensitive application.
Warning	Warning	Acoustic and optical warning as long as the level goes down. This is the factory setting.
Warning and heater off	Warning + heater off	*Warning* and additional *heater off* as long as the level goes down.
Alarm	Alarm	*Alarm* switches off the pump and the heater until the alarm is removed by pressing ↵ on the Master keyboard.

Command	Over level handling
	- Open the device parameter menu via the soft key Menu . - With the cursor keys continue to: à Settings à Over level handling. - The shown window appears. - Select the preferred parameter with or and confirm with . - See introduction for details.

7.16.4 High-level warning or alarm

% ‰ 3 Sec.	- Acoustic warning signal sounds for 3 seconds when the liquid level rises so far that the uppermost switching point of the level sensor has been reached,
% ‰ Level warning WXArn °C	or in case the warning function as described in 7.16.3 was chosen: - The acoustic signal with dual-tone sounds. - Warning WXArn 103 (high level) appears when the expansion vessel contains too much liquid. - The WXArn flashes by turns with the numeral.
% ‰ Level alarm AL 6 °C	In case the alarm function as described in 7.16.3 was chosen: - The acoustic signal with dual-tone sounds. - The red LED above the fault triangle flashes. à Heater switches off on both poles; à Pump and refrigerating unit are switched off electronically.
	- Rectify cause of fault (þ 9.4). - If Alarm: Press Enter key. Warnings disappear automatically when the cause is gone. - Also press this key if the unit has been switched off in the fault state. Warnings disappear automatically when the cause is gone.
Command	High-level warning/alarm
	- The display shows Warning. To release press Enter key Security 3 Level too high or Alarm AL 6: Level too high is shown in the display and signifies that unlocking is only possible on the Master control panel.

7.16.5 Pump-motor supervision: Overload or blockage



The SelfCheck Assistant monitors the Vario Pump:

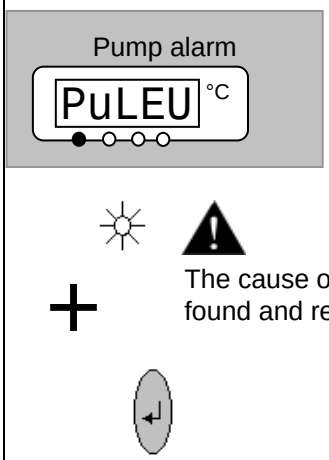
1. Alarm sounds as dual-tone signal for pump-motor overload or blockage.
2. Display of bL0C signals blockage.
3. The red LED ☼ above the fault triangle ⚠ flashes.
   à Heater switches off on both poles;
   à Pump and refrigerating unit are switched off electronically.

- Rectify cause of fault (þ 9.4).
- Press the enter key.
- Also press this key if the unit has been switched off in the fault state.

Command	Pump-motor alarm!

- Pump-motor alarm is shown in the display and signifies that unlocking is only possible on the Master control panel.

7.16.6 Pump-motor supervision: Dry running



The SelfCheck Assistant monitors the Vario Pump:

1. Alarm sounds as dual-tone signal when the pump runs without liquid.
2. The display of PuLEU signals that the SelfCheck Assistant has detected a pump low level.
3. The red LED ☼ above the fault triangle ⚠ flashes.
   à Heater switches off on both poles;
   à Pump and refrigerating unit are switched off electronically.

\+ The cause of the failure of the level measurement with the floatation sensor must be found and rectified (þ 9.4).

- Press the Enter key.
- Also press this key if the unit has been switched off in the fault state.

Command	Alarm! Low level (pump)

- Alarm! Low level (pump) is shown in the display and signifies that unlocking is only possible on the Master control panel.

7.17 RS232/RS485 Interface (only Command remote control or Module)

7.17.1 Connecting cables and interface test RS232

Computer					Thermostat		
Signal	9-pin sub-D-socket		25-pin sub-D-socket		9-pin sub-D-socket		Signal
	¬	-	¬	-	¬	-	
R x D	2	2	3	3	2	2	T x D
T x D	3	3	2	2	3	3	R x D
DTR	4		20		4		DSR
Signal Ground	5	5	7	7	5	5	Signal Ground
DSR	6		6		6		DTR
RTS	7		4		7		CTS
CTS	8		5		8		RTS

¬ with hardware handshake: For connecting a thermostat to the PC use 1:1 cable and not a null-modem cable!

- without hardware handshake: the computer / PC must be set to the operating mode “without hard ware handshake”.

+
- Use screened connecting cable.
- Connect screen to connector case.
- The connections are isolated from the remainder of the electronics.
- Any pins not in use must not be connected!!

When a PC is connected up the RS232 interface can easily be **tested** using the Microsoft Windows operating system. On Windows® 95/ 98/ NT/ XP with the „Hyper Terminal” program.

Alternatives for Windows Vista, Windows 7 and Windows 8:

- Download a freeware program from the Internet.

7.17.2 Protocol RS232

+
- The interface operates with 1 stop bit, no parity bit and 8 data bits.
- Transfer rate either 2400, 4800, 9600 (factory setting) or 19200 baud as selected.
- The RS232 interface can be operated with or without hardware handshake, (RTS/CTS).
- The command from the computer must be terminated with CR, CRLF, or LFCR.
- The response of the thermostat is always terminated with CRLF.

CR = Carriage Return (Hex: 0D)
LF = Line Feed (Hex: 0A)

Example: Transfer of setpoint 30.5 °C to the thermostat

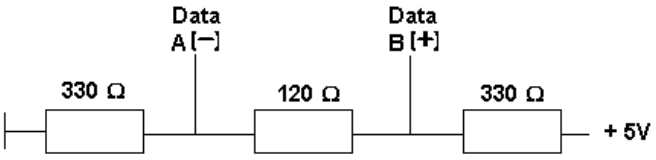
Computer	Thermostat
”OUT_SP_00_30.5“CRLF	ð
ï	“OK“CRLF

7.17.3 Connecting cable RS485

Thermostat	
9-pin sub-D-socket	
Contact	Data
1	Data A (-)
5	SG (Signal Ground) optional
6	Data B (+)

+

- Use screened connecting cables.
- Connect screen to connector case.
- The connections are isolated from the remainder of the electronics.
- Any pins not in use must not be connected!!



An **RS485** bus always requires bus termination in the form of a termination network which ensures a defined rest status in the high-resistance phases of bus operation. The bus termination is as follows:

This termination network is usually incorporated on the PC plug-in card (RS485).

7.17.4 Protocol RS485

+

- The interface operates with 1 stop bit, no parity bit and 8 data bits.
- Transfer rate either 2400, 4800, 9600 (Factory setting) or 19200 baud as selected.
- The RS485 commands are always preceded by the device address. There is provision for 127 addresses. The address must always have 3 digits. (A000_...to A127_...)
- The command from the computer must be terminated with CR.
- The response of the thermostat is always terminated with CR.

CR = Carriage Return (Hex: 0D)

Example: Transfer of setpoint 30.5 °C to the thermostat with address 15.

Computer	Thermostat
“A015_OUT_SP_00_30.5“CR	ð
ï	“A015_OK“CR

7.17.5 Write commands (Data commands to the thermostat)

Command	Explanation
OUT_PV_05_XXX.XX	External temperature to be set through the interface.
OUT_SP_00_XXX.XX	Setpoint transfer with up to 3 places before the decimal point and up to 2 places behind.
OUT_SP_01_XXX	Pump power level 1 to 8.
OUT_SP_02_XXX	Cooling operating mode cooling (0 = OFF / 1 = ON / 2 = AUTOMATIC).
OUT_SP_04_XXX.X	TiH outflow temperature high limit.
OUT_SP_05_XXX.X	TiL outflow temperature low limit.
OUT_SP_06_X.XX	Set pressure (with pressure control)
OUT_PAR_00_XXX	Setting of the control parameter Xp.
OUT_PAR_01_XXX	Setting of the control parameter Tn (5...180s; 181 = Off).
OUT_PAR_02_XXX	Setting of the control parameter Tv.
OUT_PAR_03_XX.X	Setting of the control parameter Td.
OUT_PAR_04_XX.XX	Setting of the control parameter KpE.
OUT_PAR_05_XXX	Setting of the control parameter TnE (0...979s; 980 = Off).
OUT_PAR_06_XXX	Setting of the control parameter TvE (0 = OFF).
OUT_PAR_07_XXXX.X	Setting of the control parameter TdE.
OUT_PAR_09_XXX.X	Setting of the correction limitation
OUT_PAR_10_XX.X	Setting of the control parameter XpF.
OUT_PAR_14_XXX.X	Setting of the setpoint offset.
OUT_PAR_15_XXX	Setting of the control parameter PropE
OUT_MODE_00_X	Master keyboard: 0 = free / 1 = locked (corresponds to “KEY”).
OUT_MODE_01_X	Control: 0 = internal / 1 = external Pt100 / 2 = external analogue / 3 = external serial.
OUT_MODE_03_X	Command remote control keyboard: 0 = free / 1 = locked
OUT_MODE_04_X	Setpoint offset source: 0=normal / 1=ext. Pt / 2=ext. analog / 3=ext. serial.
START	Switches the device on (after Standby). **See safety information (þ 7.9.3).**
STOP	Switches the device into Standby (pump, heater, cooling unit OFF).
RMP_SELECT_X	Selection of program (1...5) to which the further instructions apply. When the device is switched on, program 5 is selected automatically.
RMP_START	Start the programmer.
RMP_PAUSE	Hold (pause) the programmer.
RMP_CONT	Restart the programmer after pause.
RMP_STOP	Terminate the program.
RMP_RESET	Delete the program (all Segments).
RMP_OUT_00_XXX.XX_XXXXX_XXX.XX_X	Sets a programmer segment (temperature, time, tolerance and pump level). A segment is added and appropriate values are applied to it.
RMP_OUT_02_XXX	Number of program loops: 0 = endless / 1...250.

+

- For "_" use also " " (blank character).
- Response from thermostat "OK" or in case of error " ERR_X" (RS 485 interface e.g. "A015_OK" or in case of error "A015_ERR_X".).

Permitted data formats:

-XXX.XX	-XXX.X	-XXX.	-XXX	XXX.XX	XXX.X	XXX.	XXX
-XX.XX	-XX.X	-XX.	-XX	XX.XX	XX.X	XX.	XX
-X.XX	-X.X	-X.	-X	X.XX	X.X	X.	X
-.XX	-.X	.XX	.X				

7.17.6 Read commands (Data requested from the thermostat)

Command	Explanation
IN_PV_00	Query of outflow temperature.
IN_PV_01	Query of controlled temperature (int./ext. Pt/ext. Analogue/ext. Serial).
IN_PV_02	Query of outflow pump pressure in bar.
IN_PV_03	Query of external temperature TE (Pt100).
IN_PV_04	Query of external temperature TE (Analogue input).
IN_PV_05	Query of bath level.
IN_PV_10	Query of outflow temperature **in 0.001 °C.**
IN_PV_13	Query of external temperature TE (Pt100) in 0.001 °C.
IN_SP_00	Query of temperature setpoint.
IN_SP_01	Query of current pump power level
IN_SP_02	Query of cooling operation mode (0 = OFF / 1 = ON / 2 = AUTOMATIC).
IN_SP_03	Query of current overtemperature switch-off point.
IN_SP_04	Query of current outflow temperature limit TiH.
IN_SP_05	Query of current outflow temperature limit TiL.
IN_SP_06	Query of set pressure (at pressure control)
IN_PAR_00	Query of control parameter Xp.
IN_PAR_01	Query of control parameter Tn (181 = OFF).
IN_PAR_02	Query of control parameter Tv.
IN_PAR_03	Query of control parameter Td.
IN_PAR_04	Query of control parameter KpE.
IN_PAR_05	Query of control parameter TnE (980 = OFF).
IN_PAR_06	Query of control parameter TvE (0 = OFF)
IN_PAR_07	Query of control parameter TdE.
IN_PAR_09	Query of correction limitation
IN_PAR_10	Query of the control parameter XpF.
IN_PAR_14	Query of setpoint offset.
IN_PAR_15	Query of control parameter PropE
IN_DI_01	Status of contact input 1: 0 = open/ 1 = closed.
IN_DI_02	Status of contact input 2: 0 = open/ 1 = closed.
IN_DI_03	Status of contact input 3: 0 = open/ 1 = closed.
IN_DO_01	State of Contact output 1: 0 = make-contact open / 1 = make-contact closed.
IN_DO_02	State of Contact output 2: 0 = make-contact open / 1 = make-contact closed.
IN_DO_03	State of Contact output 3: 0 = make-contact open / 1 = make-contact closed.

Command	Explanation
IN_MODE_00	Master keyboard: 0 = free / 1 = locked
IN_MODE_01	Control: 0 = int. / 1 = ext. Pt100 / 2 = ext. analogue / 3 = ext. serial.
IN_MODE_02	Standby: 0 = Unit ON / 1 = Unit OFF.
IN_MODE_03	Command remote control keyboard: 0 = free / 1 = locked
IN_MODE_04	Setpoint offset source: 0=normal / 1=ext. Pt / 2=ext. analogue / 3=ext. serial.
TYPE	Query of device type (response = “XT”)
VERSION_R	Query of software version number of control system.
VERSION_S	Query of software version number of protection system.
VERSION_B	Query of software version number of Command.
VERSION_T	Query of software version number of cooling system.
VERSION_A	Query of software version number of analogue module.
VERSION_V	Query of software version number of RS232/485 module.
VERSION_Y	Query of software version number of Ethernet module
VERSION_Z	Query of software version number of EtherCAT module
VERSION_D	Query of software version number of digital (contact I/ 0) module.
VERSION_M_0	Query of software version number of solenoid valve (cooling water)
VERSION_M_3	Query of software version number of solenoid valve (reverse flow protection device 1)
VERSION_M_4	Query of software version number of solenoid valve (reverse flow protection device 2)
VERSION_P_0	Query of software version number of pump module 0
VERSION_P_1	Query of software version number of pump module 1
VERSION_P_2	Query of software version number of pump module 2
VERSION_P_3	Query of software version number of pump module 3
STATUS	Query of the equipment status 0 = OK, -1 = error.
STAT	Query for the error diagnosis response: XXXXXXX ® X = 0 no error, X = 1 error. 1st character = error. 2nd character = Alarm. 3rd character = Warning. 4th character = over temperature. 5th character = low level error. 6th character = high level error (at adjustment alarm). 7th character = no external control variable.
RMP_IN_00_XXX	Query of a program segment XXX (response: e. g. 030.00_010.00 => set point temperature 30.00 °C, time = 10 min, tolerance = 5.00 K, pump level = 1).
RMP_IN_01	Query of the current segment number.
RMP_IN_02	Query of the set number of program loops
RMP_IN_03	Query of the current program loops
RMP_IN_04	Query of the program to which further instructions apply.
RMP_IN_05	Query of which program is currently running (0 = none).
LOG_IN_00_XXXX	Query of a measuring point XXXX from data logger (Reply: e. g. 020.00_021.23_030.50 => set point temperature = 20.00 °C, outflow temperature = 21.23 °C, external temperature = 30.5 °C).
LOG_IN_01	Query of all measuring points from data logger As a difference to the command “LOG_IN_00”, a tabulator is used here as separator instead of ‚_’ . The measuring points are separated by CR and LF. The end is marked by CR LF CR LF.

Command	Explanation
LOG_IN_02	Query of the start time from the data logger (Reply: e.g. 20_14_12_20 => day 20, 14:12:20).
LOG_IN_03	Query of acquisition interval from the data logger (Reply in seconds).

+

- For "_" use also " " (blank character).
- The equipment response is always in the fixed decimal format "XXX.XX" or for negative values "-XXX.XX" or "ERR_X". (RS 485 interface e.g. "A015_ XXX.XX" or "A015_-XXX.XX" or "A015_ERR_X").

7.17.7 Error messages

Message	Explanation
ERR_2	Wrong input (e.g. buffer overflow).
ERR_3	Wrong command.
ERR_5	Syntax error in value.
ERR_6	Illegal value.
ERR_8	Module (ext. temperature) not available.
ERR_30	Programmer, all segments occupied.
ERR_31	Set point not possible, analogue set point input ON.
ERR_32	TiH <= TiL.
ERR_33	No external sensor.
ERR_34	Analogue value not available.
ERR_35	Automatic is selected.
ERR_36	No set point input possible. Programmer is running or is paused.
ERR_37	No start from programmer possible, analogue setpoint input is switched on.

7.17.8 Driver-software for LABVIEW®

An individual, easy-to-use control and automation software for operating the Integral XT device and PROLINE device can be programmed with the aid of the National Instruments program development tool LABVIEW® (http://sine.ni.com/apps/we/nioc.vp?cid=1381&lang=US).
In order to make program operation possible on the RS 232/RS 485 interface, LAUDA provides drivers specially designed for LABVIEW® which can be downloaded free of charge under www.lauda.de/spec-e.htm.

8 Interface modules

8.1 Installing of modules

The Master and Command can be supplemented with further interface modules. They will be simply inserted in 2 module cavities, at the front of the floor-standing device or at the right side of the bench-top device.

Bench-top device

- Touch the bare part of the interface panel on the Integral XT to discharge any electrostatic charge.
- Switch off the Integral XT thermostat and pull out the mains plug.
- Remove the module from its packaging.
- Insert a screwdriver into the lower recess of the module cavity and prise up the plastic cover. The cover can then be pulled off downwards.

Floor-standing device

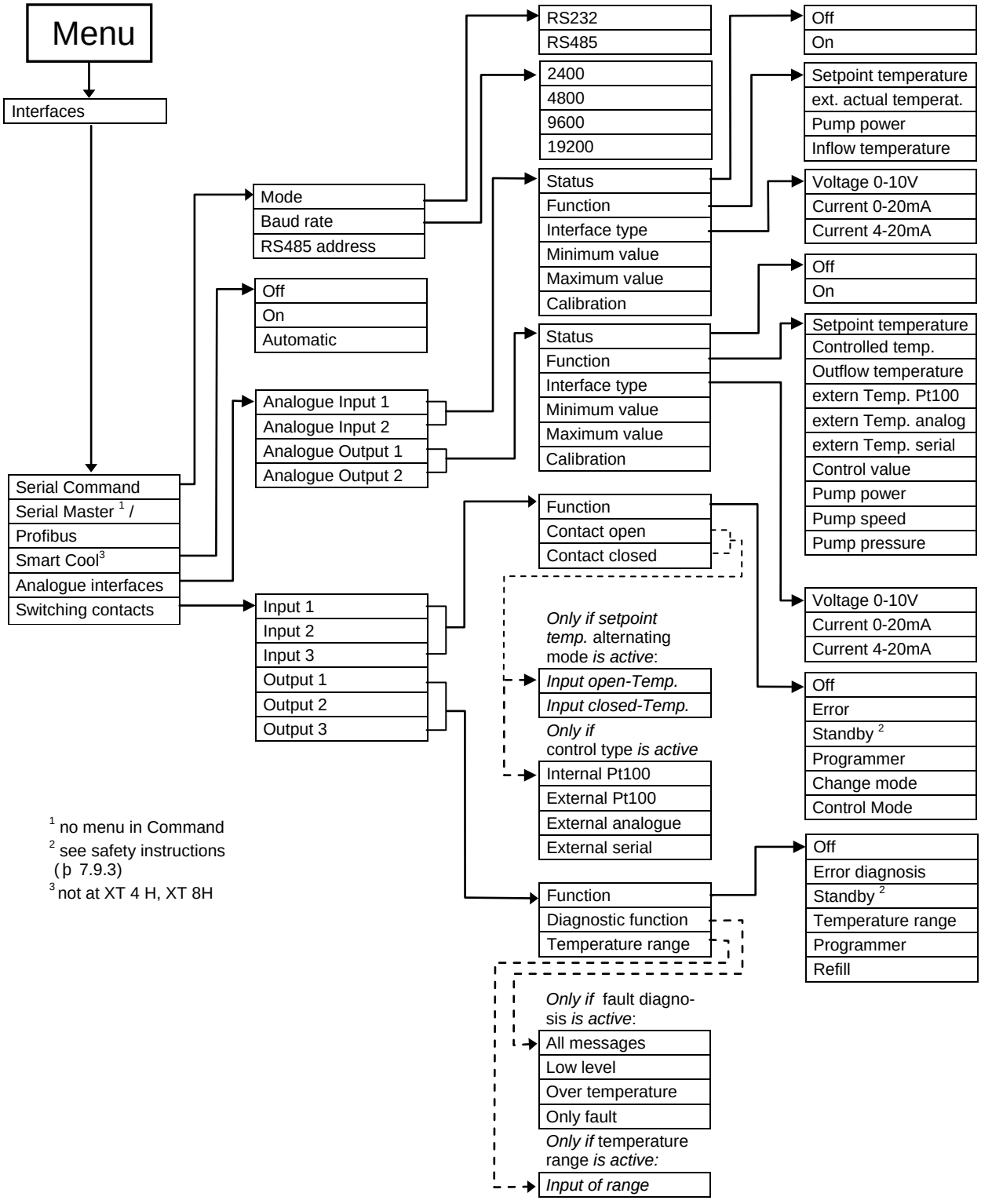
- Pull out the plug of the bus connecting cable from the plastic cover.

- Plug on the bus connecting cable (red plug onto red socket).
- Insert the module and secure with the two cross-head screws.
- Connect the mains plug again and switch on the Integral XT.

\+ The plugs are protected against reverse polarity. The plugs have a ridge which slides into a groove in the socket.

8.2 Menu structure for all modules

All existing menu points are illustrated. However, the Command remote control masks out menu points which cannot be executed. Further information can be found in the following sections.



[1] no menu in Command
[2] see safety instructions (Þ 7.9.3)
[3] not at XT 4 H, XT 8H

8.3 Serial interfaces RS232/485

RS232/485 Interface Module (order no. LRZ 913) with 9-pole SUB-D socket. Electrically isolated by optocoupler. With the LAUDA instruction set essentially compatible to the ECO, Ecoline, Proline and Integral T Series. The RS232 interface can be connected directly to the PC with a 1:1 through-contact cable (order no. EKS 037).

Interface description and commands see chapter 7.17.

8.4 Analogue module

The analogue module (order no. LRZ 912) has 2 inputs and 2 outputs which are brought out on a 6-pole DIN socket to Namur Recommendation (NE28). The inputs and outputs can be set independently as 4…20 mA, o…20 mA or 0…10 V interface. Various functions can be selected for the inputs and outputs. Accordingly, the signal on the input is interpreted differently and different information is output via the output connection.
In addition the interfaces can be scaled freely according to the set function.
For measuring transducer is 20 V DC available.

The following values can be specified via the input:

- Setpoint temperature with function: `MN tS` or Set temperature.
- Return flow temperature T_{ret}
- External actual temperature with function: `MN tE` or ext. actual temperature.
- Pump power with function: `MN PP` or Pump power.

The following values can be specified via the outputs:

- Setpoint temperature with function: Master: `MN tS` or Command: Set temperature.
- The temperature source with which active control occurs: `MN tC` Controlled temp.
- Outflow temperature: `MN t1` or Outflow temp.
- External actual temperature from Pt100: `MNtEP` or Temp. external Pt100.
- External actual temperature from analogue input: `MNtEA` or Temp. external analogue.
- External actual temperature from the serial interface: `MNtES` or Temp.external serial.
- Actuating signal: `MN Y` or Actuating signal.
- Pump power: `MN PP` or Pump power.
- Pump speed: `MNtEn` or Pump speed.
- Pump pressure.

In addition the interfaces can be scaled freely with `L =0` / `H 10=0` in % or minimal value / maximal value according to the set function.

For example: 4 mA corresponds to 0 °C and 20 mA corresponds to 100 °C.

- Accuracy of the inputs and outputs after calibration better than 0.1 % F.S.

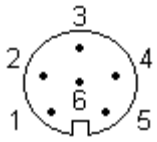
+

- Inputs, current	Input resistance < 100 Ohm
- Inputs, voltage	Input resistance > 50 kOhm
- Outputs, current	Burden < 400 Ohm
- Outputs, voltage	Load > 10 kOhm

Connection of the analogue inputs and outputs

A 6-pole round connector with screw locking and contact arrangement according to DIN EN 60130-9 or IEC 130-9 is needed.
A suitable coupling plug can be obtained under order no. EQS 057.

View of the socket (front) or solder side of plug:



socket 74S since May 2010

Pin 1 Output 1
Pin 2 Output 2
Pin 3 0V reference potential
Pin 4 Input 1
Pin 5 +20 V (max. 0,1 A)
Pin 6 Input 2

socket 71S till end 2006

Pin 1 Output 1
Pin 2 Output 2
Pin 3 0V reference potential
Pin 4 Input 1
Pin 5 0V reference potential
Pin 6 Input 2

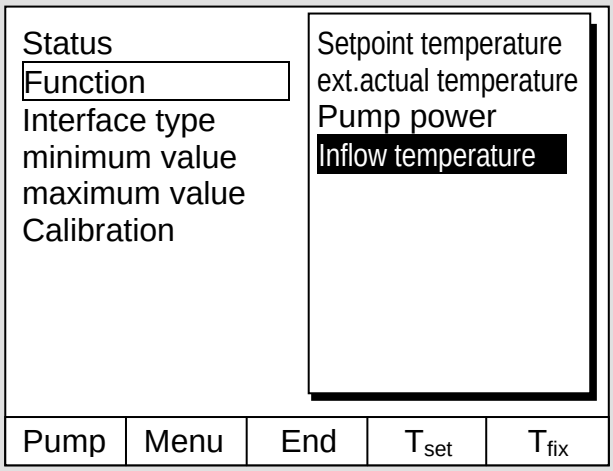
socket 74S from 2007 on till April 2010

Pin 1 Output 1
Pin 2 Output 2
Pin 3 0V reference potential
Pin 4 Input 1
Pin 5 +24 V (max. 0,1 A)
Pin 6 Input 2

\+ Use shielded lines. Connect shielding with connector housing!

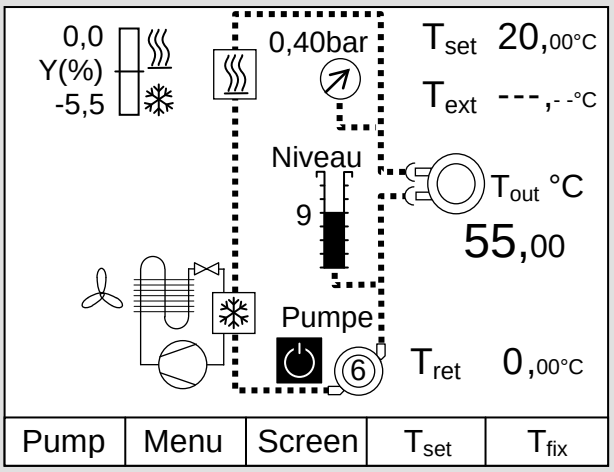
Show Inflow temperature T_{ret} in process overview window

Command	Inflow temperature



Show Inflow temperature T_{ret} in display:

- Open the device parameter menu via the soft key Menu .
- With the cursor keys continue to: à Interfaces à Analogue interfaces à Analogue Input 1 / 2 à Function à Inflow temperature.
- Confirm selection with ↵,
- or quit the window with esc without making changes.



- T_{ret} is displayed in the process overview window.

8.5 Contact module

8.5.1 Contact module LRZ 915 with three inputs and three outputs

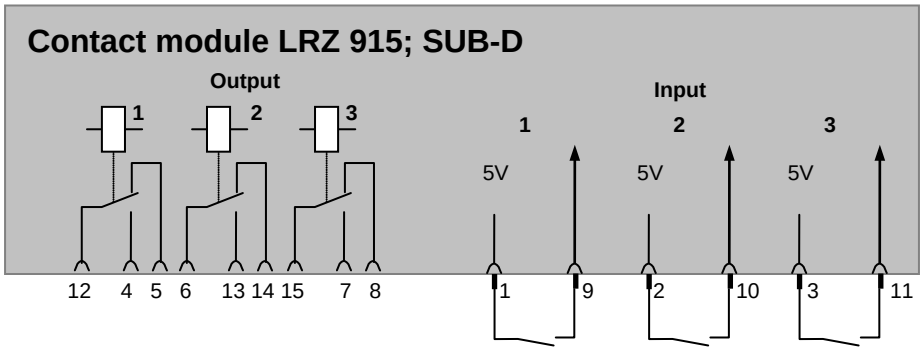
Contact module (order no. LRZ 915) on 15 pole SUB-D socket. With three relay contact outputs (changeover, max. 30 V/0.2 A) and three binary inputs for control via external voltage-free contacts.

The following functions are made available by the inputs:

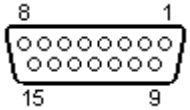
- Set fault with function: Master: `F ALA` or Command: Fault.
- Set Standby with function: `F Stb` or Standby. See safety information (þ 7.9.3).
- Control programmer (Input 1 activates programmer 1, input 2 activates programmer 2 etc. At the first “close” the programmer gets starting, “open” removes it in “pause”. The next “close” initiate “continue”) with function: `F Pr6` or Programmer.
- Control alternating mode (the switching state contact “open“ or “closed” allot to two different set point temperatures) : `F t2C` or alternating mode.
- Controller mode the switching state input “open” or “closed” can allotted to two different control temperature sources. E. g. internal « external control): `F Con` or type of control.

The following functions are made available by the outputs:

- Signal various fault states: `F diA` or fault diagnosis.
- Signaling standby: `F Stb` or Standby.
- Providing status of the window discriminators (inside « outside): `F WXi` or temperature range.
- Providing the programmer status: `F Pr6` or Programmer.
- Signalling refill of heat transfer liquid: `F F1L` or Refill.



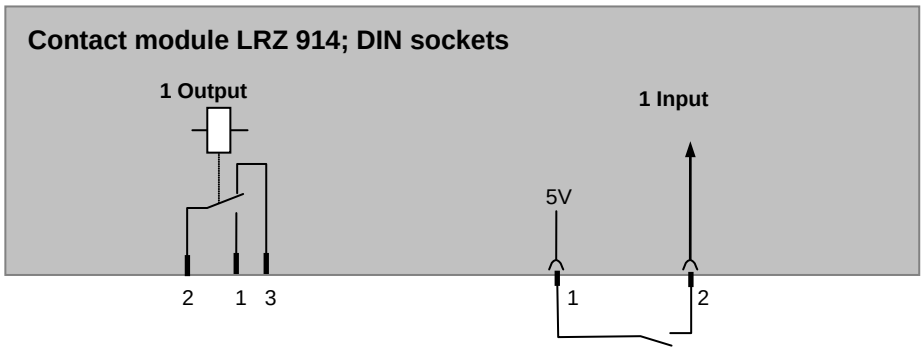
Contact inputs and outputs



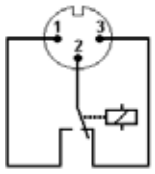
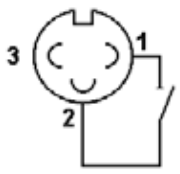
- View of the socket from the plug side or of the plug on the solder side.
- A suitable 15-pole Sub-D plug can be obtained together with a suitable housing:
  Order no. EQM 030 and plug housing order no. EQG 017.

8.5.2 Namur-Contact module LRZ 914 with only one input and one output

Contact module (order no. LRZ 914) with connector to NAMUR NE28. Functionality as LRZ 915, but only one output and one input on each of two DIN sockets.



Contact inputs and outputs:

Output	Input
- View on flange plug (Front) or solder side coupler socket. - Max. 30 V; 0.2 A. Coupler socket order no. EQD 047.	- View on flange plug (Front) or solder side coupler socket. - Signal ca. 5 V, 10 mA. Do not use pin 3! Coupling plug order no. EQS 048.
1 = n.o. (make) 2 = common 3 = n.c. (break) 	

+ Use shielded lines. Connect shielding with connector housing. Cover unused plug connections with protecting caps!

9 Maintenance

9.1 Cleaning

9.1.1 Cleaning the surface of the device

Withdraw the equipment mains plug before cleaning.

Cleaning can be carried out with water to which a few drops of surfactant (washing-up liquid) have been added and using a damp cloth.

No water must enter the control section.

+ Carry out appropriate decontamination if hazardous material is spilt on or in the equipment.

The cleaning or decontamination method is determined by the user's specialist knowledge respectively the corresponding data sheets. In case of doubt contact the manufacturer of the hazardous material.

9.1.2 Cleaning the hydraulic circuit

Refer to cleaning procedure (þ 7.8).

9.1.3 Draining the water-cooled condenser

+ **Important:** With the risk of frost (e.g. transport in winter) drain the condenser on water-cooled devices.

XT 250 W:
To do this, heat up the outflow to about 20 °C. Remove the water hose on the water tap. Set the setpoint to, for example, 10 °C and immediately after the compressor start-up, blow into the water return hose with compressed air. Continue until all water has flowed out of the device. Switch the device off immediately.

From XT 350 W:
To do this, select the condenser draining mode (þ 7.7). Remove the water hose on the water tap. Blow into the water return hose with compressed air. Continue until all water has flowed out of the device. Switch the device off immediately.

9.2 Device status

The process thermostat Integral XT can be conveniently checked with the Command remote control.

9.2.1 Interrogating the device type

Menu à Settings à Device status à Device type

With low temperature thermostats the device type is detected automatically and cannot be changed.

9.2.2 Software version

Here, only the version of the control system in the Master is displayed.

Menu à Settings à Device status à Software version.

With the Command remote control the versions of the control system (Control), safety system (Safety), Command remote control (Command), cooling system (Cool), the pump (Pump 0) and, where applicable, other connected modules are displayed.

9.2.3 Serial numbers

Menu à Settings à Device status à Serial numbers.

With the Command remote control the serial number of the Master (Master), Command remote control (Command), cooling system (Cool), pump (Pump 0) and other connected modules are displayed.

9.2.4 Device data

This display is used for diagnosis during servicing. No settings are possible here.

Command — Device data

T ext Pt	25,70	Tout	25,55
T ext analog	---,--	Mains U(%)	100,74
T ext serial	---,--	Mains Frequ.	50
T cont. head	39,80	Level	8
T heatsink	51,68	Low voltage.	27,90
Pump Pow.	44,90	5Volt Supply	OK
Pump rpm	5460	Fan voltage	7,0
Pump Cur.	1,68	Cur. cons.	10,10
Pump Volt	53,80		
Temp. pump	24°C		

Pump | Menu | End | T_{set} | T_{fix}

Menu à Settings à Device status à Device data à Display.

- T ext shows various actual temperatures in °C from the external Pt100 and modules.
- T head and T heatsink are temperatures of the electronics in the Master in °C.
- Pump power watts, – speed in rpm, current in amperes, and voltage in volts.
- Temp. pump à is the reference temperature of the pump. The value should not be above 100 °C.
- T out indicates the outflow temperature in °C.
- Mains voltage in % of setpoint and frequency in hertz.
- Level indicates the liquid level in the expansion vessel.
- Voltages on the power transformer, of the 5 V supply and fan voltages in volts.
- Cur. cons.: Total current consumption in amperes.

9.2.5 Fault memory (Command remote control)

For the analysis and localization of faults the Command version includes a fault memory in which up to 46 fault and alarm messages are saved.

Command — **Error store**

No.	Source	Code	Type	Date	Time
10	Safety	2	Alarm	----------	----------
9	Safety	4	Warn.	28.08.03	15:32:02
8	Contro.	32	Error	17.07.0310.	:52:02
7	Contro.	3	Warn.	06.06.03	11:15:11
6	Contro.	9	Alarm	05.06.03	08:45:01
5	Contro.	3	Alarm	01.06.03	17:58:22
4	Contro.	4	Warn.	28.05.03	20:01:22
3	Contro.	5	Warn.	27.05.03	07:58:00

Low level

Pump | Menu | End | T_{set} | T_{fix}

Menu à Settings à Device status à Error store à Display.

- The last message is at the top.
- Each message line can be marked with the cursor keys. The message appears in plain text in the footer.
- Under Source the CAN node is displayed which signaled the fault.
- Code is the number which in the Master is shown in the display until the cause has been rectified.
- Type: Alarm, Warning or Fault (Error).

9.2.6 Operating info

This display shows the operating hour's counter of the device.

Command — **Operating info**

Pump
Settings
Graph
Clock
Programmer
Interfaces
Control
Limits

Calibration
Works Settings
Resolution
Device Status
Display Data
Basic Settings
Overlevel Handling

Pump | Menu | End | T_{set} | T_{fix}

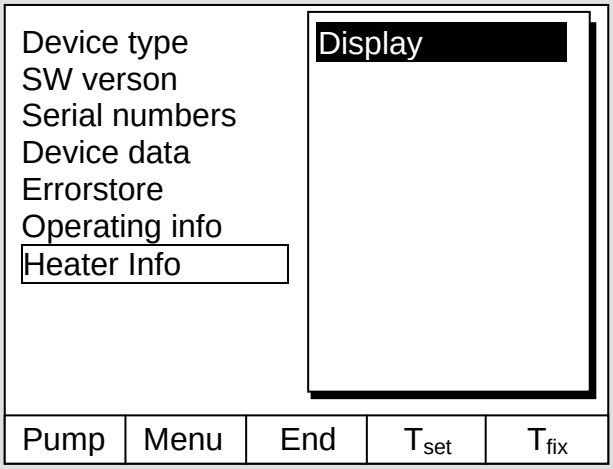
- Open the device parameter menu via the softkey Menu.
- With the cursor keys, change further to: à Settings à Device Status à Operating info à Display.

Operating info	[h]
Thermostat total	08370
Compressor 1	08034
Compressor 2	00000
at temp. >200 °C	00000

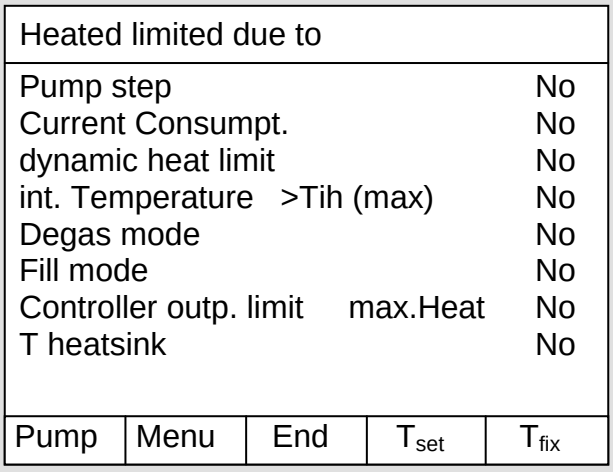
Pump | Menu | End | T_{set} | T_{fix}

9.2.7 Heater Info

Command	Operating info



- Open the device parameter menu via the softkey Menu.
- With the cursor keys, change further to: à Settings à Device Status à Heater Info à Display.



9.3 Servicing and repair

- Withdraw the mains plug before all service and repair work.
- Repairs in the control section must be carried out only by specialists.
- Keep to service and maintenance intervals according to VDI 3033. If servicing does not occur at the stated intervals, then the manufacturer can no longer guarantee the safe operation of the thermostatic circulator.

9.3.1 Service intervals

System part	Mandatory for initial operation and before any longer unsupervised operation, then with recommended frequency	Chapter	Comment
Complete device			
External condition of the device	Monthly		
Heat transfer liquid			
Analysis of heat transfer liquid	Half-yearly (and as required)	(þ 9.3.4)	
Heat transfer system			
Sealing	Daily		External visual inspection
External hoses			
Material fatigue	Monthly		External visual inspection
Cooling unit			
Cleaning of air-cooled condenser	Monthly	(þ 9.3.2)	Air-cooled thermostat
Cleaning the dirt trap	Monthly	(þ 9.3.2.2.1)	Water-cooled thermostat
Decalcifying the water cooling circuit	Quarterly	(þ 9.3.2.2.2)	Water-cooled thermostat
Electronics			
Over temperature protection	Quarterly	(þ 7.16.1)	
Pressure indication	Quarterly		Zero-point check
Low level alarm / warning	Quarterly	(þ 7.16.2)	

9.3.2 Cleaning the condenser

9.3.2.1 Air-cooled condenser

In order that the full cooling power is available, the condenser of the cooling unit must be removed of dust – at one month intervals or longer, depending on the operating time and accumulation of dust in the vicinity of the device.

The SelfCheck Assistant detects external soiling and outputs a warning.

To clean, grasp underneath of front grill cover and pull out slightly. Similarly, pull out above. Place the grill on one side.
Brush down the condenser and blow out with compressed air if necessary.
Then, press in the grill cover in the retaining bolts below and then press on the top corners.

The picture on the left shows the removal of the grill cover. This applies to floor-standing and bench-top models.

9.3.2.2 Water-cooled condenser

9.3.2.2.1 Cleaning the dirt trap

At regular intervals of one month or longer, the dirt trap must be cleaned, depending on the degree of soiling.

XT 250 W:
Take off the water feed hose on the device and remove the filter. Clean the filter and insert it again into the cooling water feed.

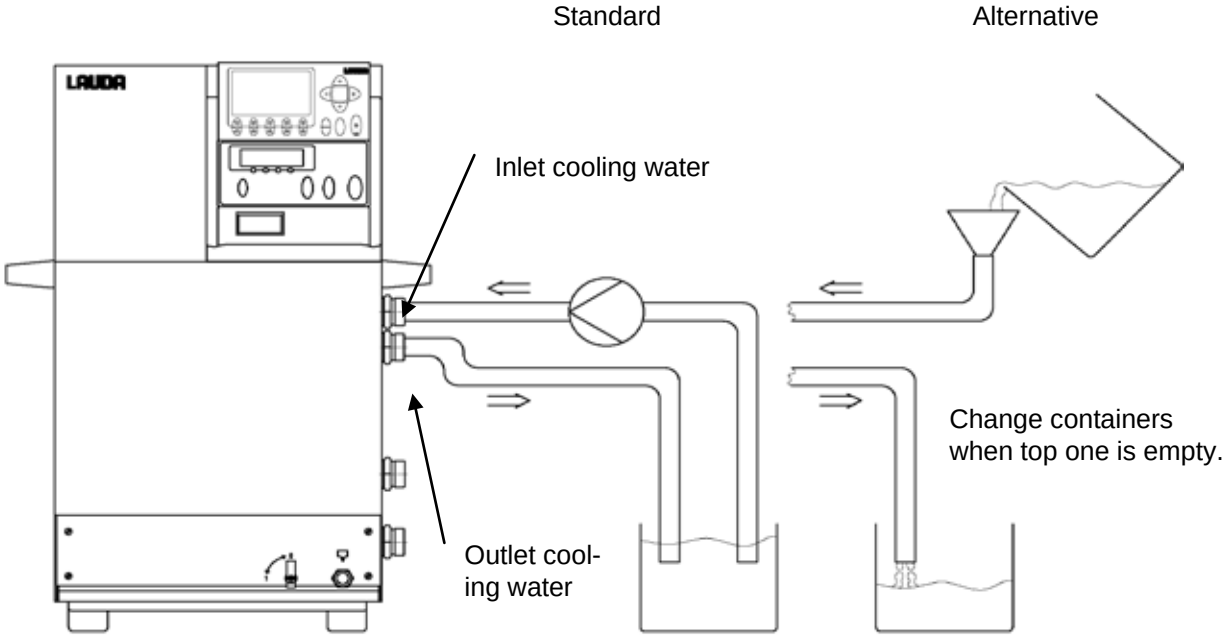
From XT 350 W:
Unscrew the panel at the back. Open the filter housing with an open-ended wrench AF 19, for XT 1590 W(S),
XT 1850 W(S) use AF 27, clean the filter and replace it.

9.3.2.2.2 Decalcifying the water cooling circuit

At regular intervals of 3 months or longer, the water-cooled condenser must be decalcified or cleaned. This depends on the hardness of the cooling water and the degree of soiling. Drain according to (þ 9.1.3).

Required equipment:

- Two containers of approx. 10 to 20 liters volume.
- Use a suitable pump (drum pump) or a hose with funnel. Place the funnel as high as possible so that the device can fill quickly.
- Fit connecting hoses between container, pump, cooling water inlet and between cooling water outlet and back to container.



XT 250 W:
Via the water inlet hose, fill the device with decalcifier (pump or hose). To do this, set the setpoint to 10 °C. After starting the compressor, the water circuit can be filled. Circulate the decalcifier with the pump resp. continue to top up the decalcifier as necessary. Allow the decalcifier to take effect (refer to table below). Drain according to (þ 9.1.3). Reconnect the device to the water supply and thoroughly flush out (refer to table below). While liquid is being pumped around the cooling water circuit, operate the device as described above at 10 °C.

From XT 350 W:
Carry on with selecting the condenser drain mode. Fill the device with decalcifier using the water feed hose. Circulate the decalcifier with the pump resp. continue to top up the decalcifier. Allow the decalcifier to take effect (refer to table below). Drain according to (þ 9.1.3). Reconnect the device to the water supply and thoroughly flush out (refer to table below).

Acting time	Continue the pump stage until most of the foamy reaction, usually at the start, has decayed. Generally, this is achieved after about 15 to 30 minutes.
Decalcifier	Only permitted: Water with LAUDA Decalcifier LZB 126 (5 kg). It is essential to follow the safety instructions and the handling instructions at the packing when handling the chemicals.
Flushing:	Allow at least 30 liters of water to flow through.

9.3.3 Fuses

Single-phase alternating current units

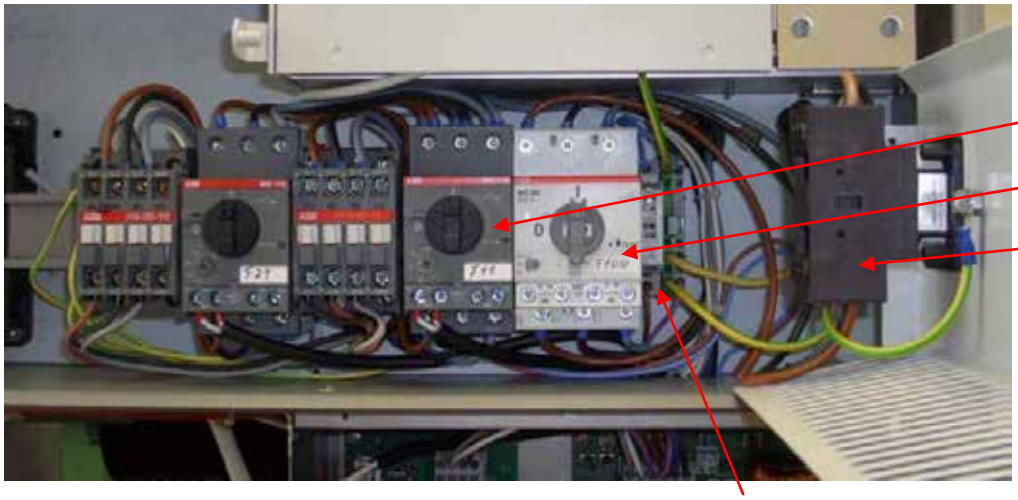
XT 150 (LWP 112/512/812) up to XT 350 HW (LWP 119/519/819).
In the event of an overload a circuit breaker interrupts the power supply. In an overload condition the circuit breaker may be manually reset by returning the switch to the “I” position.

Three-phase alternating current units

XT 490 W (LWP 339/439/539) up to XT 950 WS (LWP 554).
The main switch also acts as a circuit breaker and trips when the current becomes too high. In an overload condition the main switch may be manually reset by returning the switch to the “I” position. The compressor circuit breaker F11 is located behind the cover panel (the main switch is fitted to the panel). In an overload condition the compressor circuit breaker may be manually reset by returning the switch to the “I” position.

XT 1590 W (LWP 642/742) up to XT 1850 WS (LWP 533).
The illustration shows the motor circuit breaker F100 and the compressor circuit breaker F11 behind the cover panel. The main switch (rotary switch) is fitted to the cover panel. In an overload condition the circuit breaker may be manually reset by returning the switch to the “I” position.

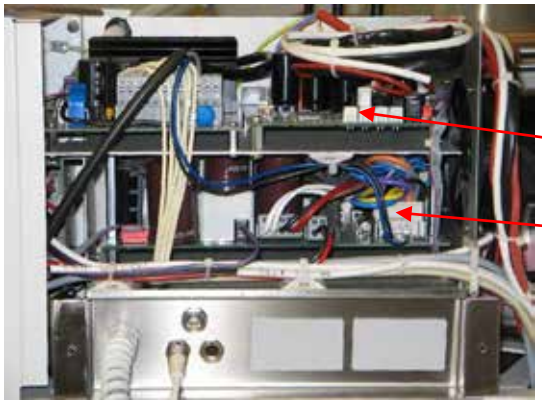
View from the front into the device.



Also, high ambient temperatures (approx. 45 to 50 °C) can trip a circuit breaker (fuse).

If the circuit breaker trips again, then the cause must be found by the LAUDA Service Constant Temperature Equipment.

Circuit boards (optional) with melting fuses in the device



XT 150, XT 250 W:

View into the device from the right side.

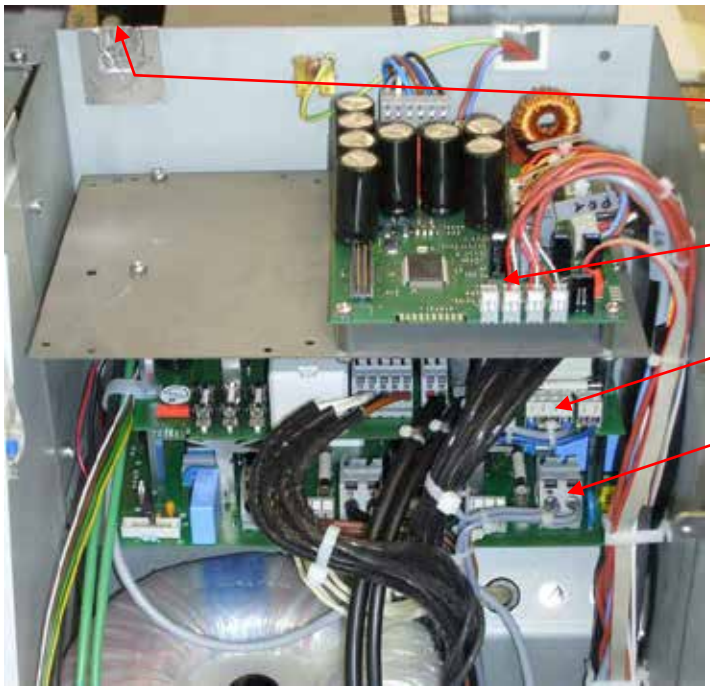
UL 533

UL 555

XT 350 W, XT 350 HW

UL 533

UL 555



All except XT 150, XT 250 W, XT 350 W, XT 350 HW.

only XT 1850 W, XT 1850 WS:
UL 555 (concealed, optional)

UL 569

UL 555

UL 571 resp. UL 558

List of the fuses in the devices

From XT 490 W upwards:
Control fuse F3 à T 0A2 (slow blow) Order no. EES 069.

Single-phase alternating current units Order no.	Circuit boards	
	UL 533 (mains)	UL 555-9 (power supply)
for all devices	---	F5/6/7 à T10A0 (slow blow) EEF 026
XT 150 LWP 112	F1 à T10A0 (slow blow) EEF 026	F3, F4 à see table below (þ 131)
XT 150 LWP 512; LWP 812	F1 à T10A0 (slow blow) EEF 026	
XT 250 W LWP 113	F1 à T10A0 (slow blow) EEF 026	
XT 250 W; LWP 513; LWP 813	F1 à T10A0 (slow blow) EEF 026	
XT 350 W LWP 117	F1 à T10A0 (slow blow) EEF 026	
XT 350 W LWP 517 ; LWP 817	F1 à T10A0 (slow blow) EEF 026	
XT 350 HW LWP 119	F1 à T10A0 (slow blow) EEF 026	
XT 350 HW LWP 519; LWP 819	F1 à T10A0 (slow blow) EEF 026	

+ For the PCB UL 555 and the fuses F3 and F4, consider the following:

- Only use UL fuses (listed according to UL 248-14!

Table fuses for single-phase alternating current units

U	A2/F3, F4 only UL fuses	
200V	10AT 250VAC	EES 004
215V	10AT 250VAC	EES 004
230V	8AT 500VAC	EES 072

View of PCB UL 555 (þ page 134)

Three-phase alternating current units Order no.	Circuit boards		
	UL 555-9 (power supply)	UL 571 (heating)	UL 563 (distributor 2)
for all devices	F5/6/7 à T10A0 (slow blow) EEF 026	---	---
XT 280 LWP 334	F3, F4 à see table (þ 134)	F1 to F6 à F 10A (quick blow) EES 067	---
XT 280 LWP 434		F1 to F6 à F 10A (quick blow) EES 067	---
XT 280 LWP 534		F1 à F6 à F 6A3 (quick blow) EES 065	---
XT 280 W LWP 535		F1 à F6 à F 6A3 (quick blow) EES 065	---
XT 490 W LWP 339	F3, F4 à see table (þ 134)	F1 to F6 à FF 12A5 (extra quick blow) EES 015	---
XT 490 W LWP 439		F1 to F6 à F 10A0 (quick blow) EES 067	---
XT 490 W LWP 539		F1 to F6 à F 6A3 (extra quick blow) EES 065	---
XT 550 LWP 324	F3, F4 à see table (þ 134)	F1 to F6 à FF 12A5 (extra quick blow) EES 015	---
XT 550 LWP 424		F1 to F6 à FF 12A5 (extra quick blow) EES 015	---
XT 550 LWP 524		F1 to F6 à F 6A3 (quick blow) EES 065	---
XT 550 W LWP 325		F1 to F6 à FF 12A5 (extra quick blow) EES 015	---
XT 550 W LWP 425		F1 to F6 à FF 12A5 (extra quick blow) EES 015	---
XT 550 W LWP 525		F1 to F6 à F 6A3 (quick blow) EES 065	---
XT 750 LWP 320	F3, F4 à see table (þ 134)	F1 to F6 à FF12A5 (extra quick blow) EES 015	---
XT 750 LWP 420		F1 to F6 à F10A0 (quick blow) EES 067	---
XT 750 LWP 520		F1 to F6 à F6A3 (quick blow) EES 065	---

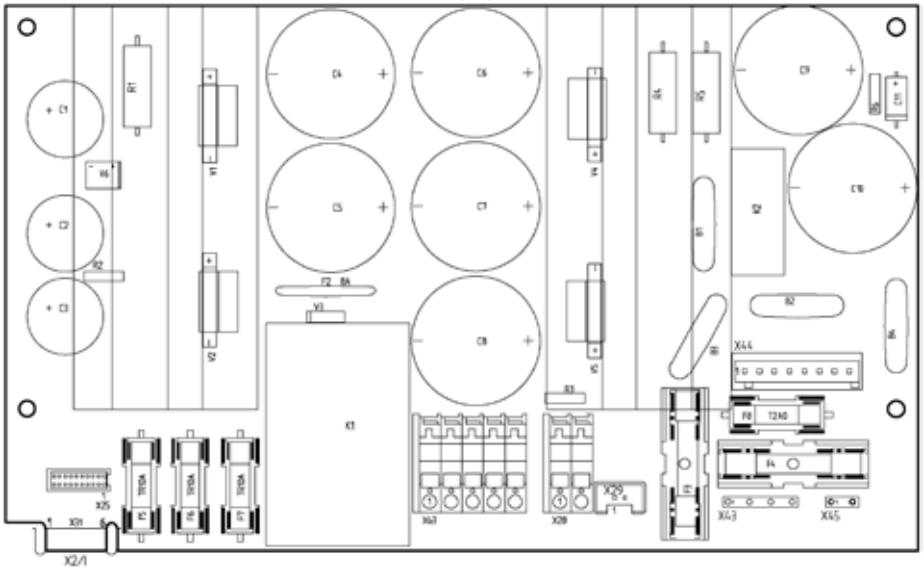
Three-phase alternating current units Order no.	Circuit boards		
	UL 555-9 (power supply)	UL 571 (heating)	UL 563 (distributor 2)
XT 750 H LWP 322	F3, F4 à see table (þ 134)	F1 to F6 à FF12A5 (extra quick blow) EES 015	---
XT 750 H LWP 422		F1 to F6 à F10A0 (quick blow) EES 067	---
XT 750 H LWP 522		F1 to F6 à F6A3 (quick blow) EES 065	---
XT 750 S LWP 552 XT 750 HS LWP 553		F1 to F6 à F10A0 (quick blow) EES 067	---
XT 950 W LWP 321	F3, F4 à see table (þ 134)	F1 to F6 à FF12A5 (quick blow) EES 015	---
XT 950 W LWP 421		F1 to F6 à F10A0 (quick blow) EES 067	---
XT 950 W LWP 521		F1 to F6 à F 6A3 (quick blow) EES 065	---
XT 950 WS LWP 554		F1 to F6 à F10A0 (quick blow) EES 067	---
XT 1590 W LWP 542	F3, F4 à see table (þ 134)	F1 to F6 à F 6A3 EES 065	---
XT 1590 W LWP 642		---	F1 à F6 à F 6A3 (quick blow) EES 065
XT 1590 W LWP 742		---	F1 à F6 à F 6A3 (quick blow) EES 065
XT 1590 WS LWP 551		F1 to F6 à F 10A0 (quick blow) EES 067	---
XT 1850 W LWP 532	F3, F4 à see table (þ 134) 2x UL 555	F1 to F6 à F10A0 (quick blow) EES 067	---
XT 1850 W LWP 632	F3, F4 à see table (þ 134) 2x UL 555	---	F1 to F6 à FF12A5 (extra quick blow) EES 015
XT 1850 W LWP 732	F3, F4 à see table (þ 134)	---	F1 to F6 à FF12A5 (extra quick blow) EES 015
XT 1850 WS LWP 533		---	F1 to F6 à FF 16A (extra quick blow) EES 071

+ For the PCB UL 555 and the fuses F3 and F4, consider the following:

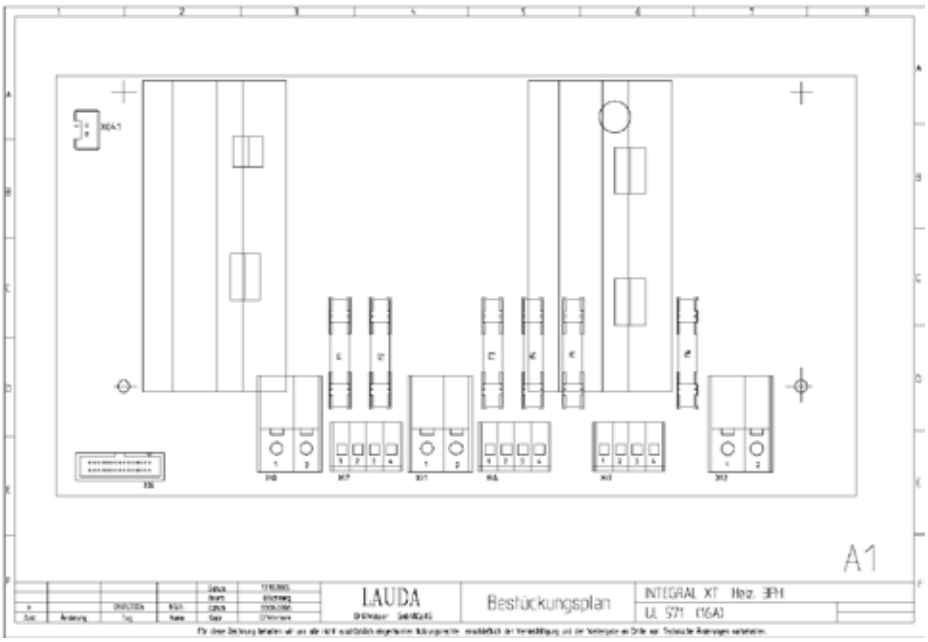
- Only use UL fuses (listed according to UL 248-14)!

Table fuses for three-phase alternating current units

U	F3/F4 only UL fuses	
200V	10AT	EES 004
215V	10AT	EES 004
230V	8AT	EES 072
400V	5AT	EES 073
440V	5AT	EES 073
480V	5AT	EES 073



Mains PCB UL 555j j



Fuses for replacement

Bench-top device

Floor-standing device

9.3.4 Testing the heat transfer liquid

If the heat transfer liquid becomes contaminated or degenerated, it should be renewed.

If required, the heat transfer should be checked for fitness for use (e.g. when changing the method of operation), or at least half-yearly. Further use of the heat transfer liquid is only permissible if the inspection indicates this.

- Address of the operating company,
- system designation,
- trade name of the heat transfer liquid, e.g. Therm 160,
- operating hours for the used heat transfer liquid,
- operating temperature and
- date.

The test of the thermal transfer medium should takes place according to DIN 51529; Testing and assessment of used heat transfer media.
Source: VDI 3033; DIN 51529.

9.3.5 Repair information

If you want to send in a device for repair, it is essential to first contact the LAUDA Service Constant Temperature Equipment (þ 9.5).

+

- When sending in a device, please ensure that it is carefully and properly packed. LAUDA cannot be held liable for any damage due to improper packing.
- For a fee, we send a new package.

9.4 Remedying faults

Before you contact the LAUDA Service Constant Temperature Equipment (þ 9.5), check whether the problem can be remedied with the following instructions:

a) **Process thermostats**

Fault	Possible remedy
Device does not cool or only very slowly.	1. The module "Smart Cool" is set to "off" à Switch on "Smart Cool" module (þ 7.15.7.1 and 8.2). 2. Actuating signal limitation is active à Switch off actuating signal limitation (þ 7.15.7.1). 3. Dirty condenser à clean condenser (þ 9.3.2). 4. Temperature limit Til too high. à Reduce temperature limit Til (þ 7.10.2).
Device does not heat up or only very slowly.	1. Actuating signal limitation is active à Switch off actuating signal limitation (þ 7.15.7.1). 2. Temperature limit Tih too low à Increase temperature limit Tih (þ 7.10.2). 3. Dynamic heating power limit active à Switch off dynamic heating power limit (þ 7.15.7.2). 4. At small pump levels the heating power is regulated automatically by the dynamic heating power control.(þ 7.15.7.3) à increase pump level.
Pump levels cannot be set.	1. Pump pressure control is active. à Switch off pump pressure control (þ 7.9.4).
Degassing does not function very well.	1. Pump pressure control is active. à Switch off pump pressure control (þ 7.9.4). 2. Pump level too high. à Select a lower pump level (þ 7.9.3). 3. Heater power too high. à Reduce heater power (þ 7.15.7.1). 4. Cooling unit active. à Switch off cooling unit (þ 7.15.7.1). 5. Heat transfer liquid heavily contaminated. à Change heat transfer liquid; to do this, completely drain the device, working with the cleaning procedure if required (þ 7.8). 6. Filling point cover closed. à Open filling point cover.

Master: Warning message WXArn 332 Command: Low flow (cooling unit). (Not enough flow in region of condenser). (þ 7.15).	1. Check whether there is a blockage in the hydraulic circuit (closed valves, pinched hose, dirt ...). à Rectify cause. 2. Pump level too low. à Select a larger pump level (þ 7.9.3). 3. Pipe cross-section is too small. à Enlarge cross-section or use bypass (þ 10 and 7.15.1). 4. Cooling power for the existing volume flow too high. à Reduce cooling power (þ 7.15.7.1).
Master: Warning message WXArn 007 Command: Low flow (heater). (Not enough flow in region of heater). (þ 7.15).	1. Check whether there is a blockage in the hydraulic circuit (closed valves, pinched hose, dirt ...). à Rectify cause. 2. Pump level too low. à Select a larger pump level (þ 7.9.3). 3. The device has not been vented or degassed sufficiently. à Degas device (þ 7.6.2 and 7.6.3). 4. Pipe cross-section is too small. à Enlarge cross-section or use bypass (þ 7.15.1 and 10). 5. Heater power for existing volume flow too high. à Limit heater power (þ 7.15.7.1 and 7.15.7.2).
Master: Alarm message tEMNP Command: Overtemperature protection. (þ 7.16.1).	1. Wait until the outflow temperature has cooled below the overtemperature cut-off point or set the cut-off point higher than the outflow temperature.
Master: Warning message WXArn 104 Command: Level very low (Imminent low level in the expansion vessel). Master: Alarm message LEUEL Command: Low level. (Low level in the expansion vessel) (þ 7.16.2).	1. Check hoses, connections and load for whether a leaky location is present. à As applicable, rectify the leakage and top up the missing heat transfer liquid (þ 7.6.4). 2. Check the Integral XT for whether a leaky location is present. à If necessary, contact LAUDA Service Constant Temperature Equipment (þ 9.5). 3. The liquid may drop due to cooling or degassing. à If necessary, top up the missing heat transfer liquid (þ 7.6.4).

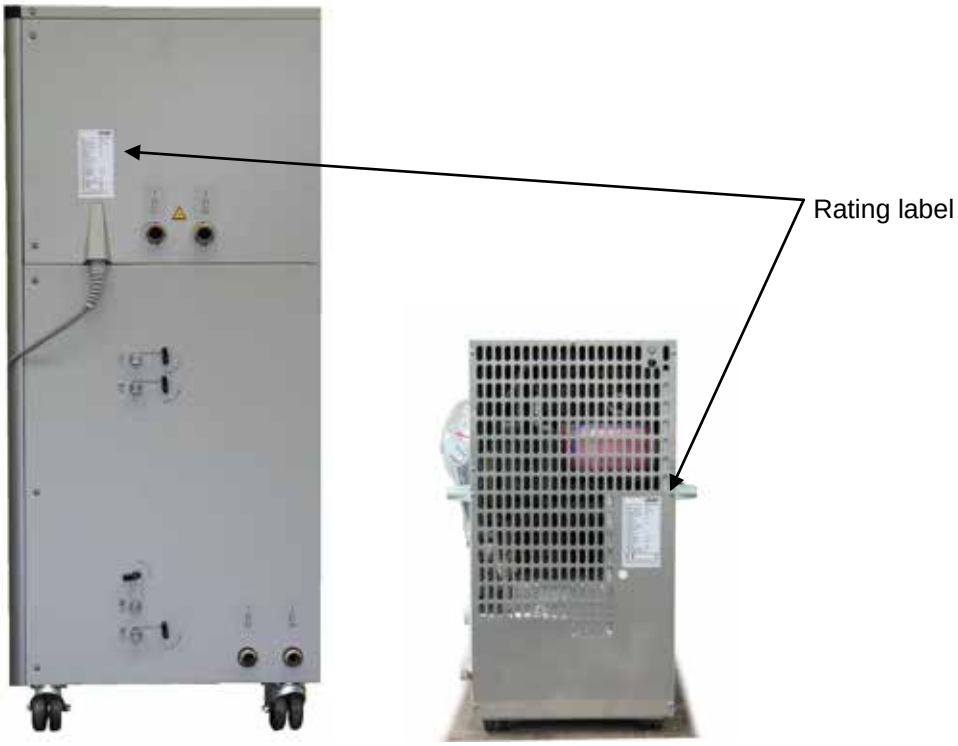
Master: Warning message WXArn 103 Command: Level too high (Imminent excessive level in the expansion vessel). Master: Alarm message AL 6 Command: Level too high (Excessive level in the expansion vessel) (þ 7.16.4).	1. Volume expansion during heating up. 2. Moisture absorption in the thermostatic medium.
Master: Alarm message blOC Command: Pump blocked (Pump motor monitoring: Overload, blockage). (þ 7.16.5).	1. The viscosity of the heat transfer liquid is too high. à Change the heat transfer liquid or raise the setpoint temperature. 2. The pump is blocked. à Contact the LAUDA Service Constant Temperature Equipment (þ 9.5).
Master: Alarm message PulEU Command: Low level (pump) (Pump motor monitoring: No load). (þ 7.16.6).	1. No liquid in the system. If this occurs, the level monitoring has failed. à Check whether the float in the expansion vessel is blocked by foreign bodies. Otherwise, contact LAUDA Service Constant Temperature Equipment (þ 9.5). 2. With the option "open load" the device draws air out of the open load. à Move the return (suction line) into the heat transfer liquid of the load.
Master: Alarm message Error 11 Command: Overpressure (outflow pressure too high).	1. Pump level too high. à Select a lower pump level (þ 7.9.3). 2. Pressure control setpoint pressure too high. à Reduce setpoint pressure (þ 7.9.4). 3. Maximum pressure too low. à Increase maximum pressure (þ 7.9.5).
Only for XT 1850 W Order No. LWP 732. Master: Alarm message Error 367 Command: Cool 367 Japan switch (Switch [400 V; 3/PE; 50 Hz or 440-480 V; 3/PE; 60 Hz] incorrectly set for existing mains voltage and frequency).	1. Switch for mains voltage setting [400 V; 3/PE~50 Hz or 440-480 V; 3/PE~60 Hz] in incorrect position à Switch off unit à Check whether existing mains voltage and frequency match [400 V; 3/PE~50 Hz or 440-480 V; 3/PE~60 Hz]; if necessary, set the switch correctly à Remove the top back panel à At the back of the unit switch the switch into the correct position à Fit the rear panel again à Switch on the unit again.

b) **High-temperature thermostats**

Fault	Possible remedy
Master: Alarm message Cool FloWX (Equipment damage (lasting damage to the high temperature valve))	1. Cooling water temperature above 80 °C and longer than 8 seconds. à Restore correct cooling water supply. Contact LAUDA Service Constant Temperature Equipment (þ 9.5). 2. Cooling water temperature above 85 °C. à Restore correct cooling water supply. Contact LAUDA Service Constant Temperature Equipment. 3. At high-temperature valve temperature above 140 °C. à Restore correct cooling water supply. Contact LAUDA Service Constant Temperature Equipment.
Master: Warning message Hk uAluE too hok (Equipment damage (lasting damage to the high temperature valve))	1. At high temperature valve temperature above 120 °C and more than 8 seconds. à Restore correct cooling water supply. Otherwise contact LAUDA Service Constant Temperature Equipment (þ 9.5).
Machine enters the degassing mode (þ 7.6.3).) (Entry of cooling water in the hydraulic circuit by defective condenser). However, please note: If necessary, the device performs a "permanentyl and automatic degassing" by (þ 7.6.3.2). This automatic process is not a malfunction.	1. Contact LAUDA Service Constant Temperature Equipment.
Entry of heat transfel liquid in the cooling water circuit by defective condenser.	1. Note Suitable cooling water quality (þ 6.2). Otherwise there is a danger of corrosion!

9.5 Service, ordering replacement parts and rating label

When ordering spares please quote serial number (rating label). This avoids queries and supply of incorrect items.



The serial number is combined like following, for example **LWP112-15-0001**

LWP112	=	catalogue number
15	=	year of manufacture 2015
0001	=	incremental numeration

Your contact for maintenance and support:

LAUDA Service Constant Temperature Equipment
Telephone: +49 (0)9343 503-372 (English and German)
Fax: +49 (0)9343 503-283
E-Mail service@lauda.de

We are available any time for your queries and ideas!

LAUDA DR. R. WOBSER GMBH & CO. KG
Pfarrstraße 41/43
97922 Lauda-Koenigshofen
Germany
Telephone: +49 (0)9343 503-0
Fax: +49 (0)9343 503-222
E-Mail info@lauda.de
Internet http://www.lauda.de

9.6 Disposal information

The following applies to Europe: Disposal of the device may only be carried out by qualified specialists according to EC Directive 303/2008/EC in conjunction with 842/2006/EC.

The disposal is regulated by EC Directive 2002/96/EC.

9.6.1 Disposal of the refrigerant

The refrigeration circuit is filled with CFC-free HFC refrigerant. The type and filling quantity can be read on the unit or on the rating plate. Repair and disposal are only to be carried out by refrigeration specialists!

Global Warming Potentials GWP
[CO_2 = 1,0]

Refrigerant	$GWP_{(100a)}$*
R23 / HFC-23	14800
R404A / HFC-404A	3922
R508A / HFC-508A	13214

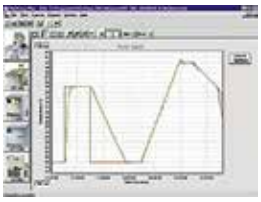
* Time span 100 years – according to IPCC IV (2007)

The following applies to Europe: The disposal of the coolant must be carried out according to EC Directive 303/2008/EC in conjunction with 842/2006/EC.

9.6.2 Disposal of the packaging

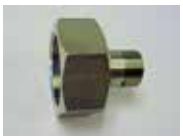
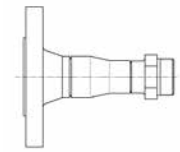
The following applies to Europe: The disposal of the packaging must be carried out according to the EC Directive 94/62/EC.

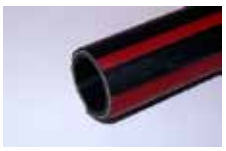
10 Accessories

Description		Application	Catalogue number
	LAUDA Wintherm Plus PC Program.	Control of the thermostat, online display of all values as a graph with free choice of time frame. Incl. RS232 cable (2 m).	LDSM2002
	T-piece connection for the internal LAUDA device bus (LiBus)¬	For the connection of further LiBus ¬ components (with heating thermostats two LiBus ¬ connections are not occupied and one with cooling thermostats).	EKS 073
	Extension cable for LiBus ¬ 5 m	For LiBus ¬ components, but especially for remote operation with the Command remote control.	EKS 068
	Extension cable for LiBus ¬ 25 m		EKS 069
	Equipment trolley for bench-top cooling thermostats	Movable on lockable castors, height adjusts from 370 mm to 455 mm, footprint 555 mm x 465 mm, holds up to 160 kg load.	LCZ 036
	Roller kit option, only factory fitting	4 rollers, 2 with brake; suitable for XT 150 and XT 250 W	LWZ 051
	Ball cock for thermostating circuit	M16 x 1 I to M16 x 1 A; temperature range: -30 to 180 °C	LWZ 047

¬ LiBus = LAUDA internal BUS (based on CAN)

Interfaces and modules			
	RS232/485 Interface Module	Digital communication, operation of the LAUDA PC software Wintherm Plus (þ 7.17).	LRZ 913
	RS232 cable (2 m)	Thermostat-PC Sub-D (9 pin. 9 pin).	EKS 037
	RS232 cable (5 m)	Thermostat-PC Sub-D (9 pin. 9 pin).	EKS 057
	Analog module	Current and voltage interfaces (þ 8.4).	LRZ 912
	Contact module with 3 inputs and outputs	Input and output of device signals (þ 8.5.1).	LRZ 915
	Contact module with 1 input and 1 output	NAMUR NE28 functionality (þ 8.5.2).	LRZ 914
	Profibus module	Digital communication via field bus, Profibus.	LRZ 917
Heat transfer liquids (þ 6.2)			
	Ultra 350	For safe and reliable operation the correct choice of heat transfer liquid is of crucial importance. Containers in 5, 10 and 20 liters size.	LZB 107, LZB 207, LZB 307
	Kryo 30		LZB 109, LZB 209, LZB 309
	Kryo 70		LZB 127, LZB 227, LZB 327
	Kryo 90		LZB 128, LZB 228, LZB 328

Adapter M30 x 1.5 (according to DIN 3863 and DIN 3870)			
	Reduction	M30 x 1.5 I to M16 x 1 A	UD 660
	Reduction	M30 x 1.5 A to M16 x 1 I	HKA 152
	Double nipple	M30 x 1.5	EOV 208
	Screw-in sleeve	M30 x 1.5 A to G ¾‘‘A	EOV 194
	Flange adapter	M30 x 1.5 A to DIN 2633/DN25	HKA 156
	Union nut	M30 x 1.5	EOV 196
	Olive	¾" olive with ball-type nipple for M30 x 1.5	HKA 162
	Angular screwed joint	M30 x 1.5 I to M30 x 1.5 A	HKA 153
	By-pass	M30 x 1.5 I to M30 x 1.5 A; Temperature range -40 to 350 °C. Use recommended with connection of loads with high hydraulic resistance (low cross-section à low flow).	LWZ 046
	By-pass	M30 x 1.5 I to M30 x 1.5 A; Temp. range: -90 to 220 °C.	LWZ 089
Adapter M16 x 1 (according to DIN 3863 and DIN 3870)			
	Olive	½" olive with ball-type nipple for M16 x 1 union nut.	HKO 026

Metal thermostat hoses (þ 6.2)			
	MXC 100S; 100 cm	M30 x 15 I both ends; -50 to 300 °C	LZM 081
	MXC 200S; 200 cm	M30 x 1.5 I both ends; -50 to 300 °C	LZM 082
	MXC 300S; 300 cm	M30 x 1.5 I both ends; -50 to 300 °C	LZM 083
Metal thermostat hoses M 38x1.5 suitable for XT 1850 W (þ 6.2)			
	MX2C 100S; 100 cm	M38 x 1.5 I both ends; -50 to 300 °C	LZM 084
	MX2C 200S; 200 cm	M38 x 1.5 I both ends; -50 to 300 °C	LZM 085
	MX2C 300S; 300 cm	M38 x 1.5 I both ends; -50 to 300 °C	LZM 086
Cooling water hoses; thermostat hoses (EPDM*)			
	Rubber hose	1/2", textile reinforced; -40 to 100 °C; max. 20 bar	RKJ 031
	Rubber hose for XT 250 W, XT 350 HW, XT 950 W	3/4", textile reinforced; -40 to 100 °C; max. 20 bar	RKJ 032
	Rubber hose for XT 1850 W	1", textile reinforced; -40 to 100 °C; max. 20 bar	RKJ 033
* EPDM hose is not suitable for Ultra 350 and mineral oils.			
Quick-release couplings			
	Coupling socket	Socket G3/4" I; suitable for EOA 007	EOA 006
	Coupling plug	for ½" hose	EOA 007
	Coupling socket	Socket G1" I; suitable for EOA 026	EOA 027
	Coupling plug	for ¾" hose	EOA 026

Other accessories on request (þ 9.5).
Also refer to our special and accessory brochures.

11 Technical data

Note

Devices, with the corresponding serial numbers, are upgradeable, up to a maximum operating temperature of 220 °C.

these devices are upgradeable up to 220 °C	from the serial number
XT 150	LWPxxx-11-0101
XT 250 W	LWPxxx-11-0101
XT 350 W	LWPxxx-11-0101
XT 750	LWPxxx-11-0101
XT 950 W	LWPxxx-11-0101
XT 1850 W	LWPxxx-11-0101
XT 1850 WS	LWPxxx-11-0101

The figures have been determined according to DIN 12876.

Table 1 Process thermostats				XT 150	XT 250 W	XT 280	XT 280 W	XT 350 W	XT 350 HW
Operating temp./ACC range			°C	-45...220	-45...220	-80...220	-80...220	-50...220	-50...300
Ambient temp. range			°C	5..40					
Humidity				maximum relative humidity 80 % for temperatures up to 31 °C, decreasing linearly to 50 % relative humidity at 40 °C					
Device distance to the surroundings									
front			cm	50	20	50	20	20	20
back			cm	50	20	50	20	20	20
right			cm	50	20	50	20	20	20
left			cm	50	6	50	6	6	6
Storage temperature range			°C	-20...44 the condenser must be completely emptied by a water-cooled device (þ 9.1.3)					
Setting resolution			°C	0.01					
Display resolution			°C	Master: 0.01 Command: 0.1 / 0.01 / 0.001					
Display accuracy				0.2 °C can be calibrated additively					
Filling volume, minimum			L	2.6	2.6	5.0	5.0	5.0	5.3
Additional filling volume in the expansion vessel			L	5.5	5.5	6.7	6.7	6.7	6.7
Refrigerant				R404A	R404A	R404A & R23	R404A & R23	R404A	R404A
Cooling refrigerating unit				Air	Water	Air	Water		
Cooling air temperature range without performance loss			°C	10…20	10…40	10…20	10…40		
Cooling water connections				---	R¾" A	---	R¾" A		
minimum diameter of the cooling water hose			mm	---	13	---	13		
Cooling water temperature range / without performance loss			°C	---	10…30 10…15	---	10…30 10…15	10…30 10…15	10…30 10…15
Cooling water pressure			bar	---	3…10	---	3…10	3…10	3…10
Cooling water consumption temperature 15 °C, pressure 3bar ¯			L/h	---	300	---	900	800	800
Cooling power at 20 °C ambient temperature; cooling water temperature 15 °C; cooling water pressure 3 bar; pump level 4 ①; if not different noted	Thermal transfer oil -	300 °C	KW	---	---	---	---	---	12.00
		200 °C	KW	1.50 ®	2.10 ®	1.50 Â	2.00 Â	3.10	12.00
		100 °C	KW	1.50 ®	2.10 ®	1.50 Â	2.00 Â	3.10	6.00
	Ethanol	20 °C	KW	1.50 ®	2.10 ®	1.50 Â	2.00 Â	3.10	3.10
	Ethanol	10 °C	KW	1.30 ®	1.80 ®	1.50 Â	2.00 Â	3.10	3.10
	Ethanol	0 °C	KW	1.10 ®	1.30 ®	1.40 Â	2.00 Â	3.10	3.10
	Ethanol	-10 °C	KW	1.00 ®	1.00 ®	1.40 Â	1.90 Â	2.00	2.00
	Ethanol	-20 °C	KW	0.62 ®	0.62 ®	1.30 Â	1.80 Â	1.20	1.20
	Ethanol	-30 °C	KW	0.28 ®	0.28 ®	1.30 Â	1.70 Â	0.70	0.70
	Ethanol	-40 °C	KW	0.06 ®	0.06 ®	1.30 Â	1.60 Â	0.25 ®	0.25 ®
	Ethanol	-50 °C	KW	---	---	1.20 Â	1.40 Â	0.02 ®	0.02 ®
	Ethanol	-60 °C	KW	---	---	1.00 Â	1.00 Â	---	---
	Ethanol	-70 °C	KW	---	---	0.40 Â	0.40 Â	---	---
	Ethanol	-80 °C	KW	---	---	0.10 ®	0.10 ®	---	---
	Ethanol	-90 °C	KW	---	---	---	---	---	---
Temperature stability at -10 °C, ethanol with external load			±K	0.05	0.05	0.1	0.1	0.10	0.10
			L	2	2	2	2	5	5

Table 1 Process thermostats			XT 150	XT 250 W	XT 280	XT 280 W	XT 350 W	XT 350 HW
Heater power / Power consumption								
230 V; 50 Hz		kW	3.5 / 3.68	3.5 / 3.68	---	---	3.5 / 3.68	3.5 / 3.68
208 - 220 V; 3/PE~60 Hz		kW	---	---	2.9 / 7.0	2.9 / 7.0	---	---
200 V; 3/PE~50/60 Hz		kW	---	---	2.65 / 6.5	2.65 / 6.5	---	---
200 V; 50/60 Hz		kW	2.65 / 3.2	2.65 / 3.2	---	---	2.65 / 3.2	2.65 / 3.2
400 V; 3/PE~50 Hz		KW	---	---	4.0 / 9.0	4.0 / 9.0	---	---
208 - 220 V; 60 Hz		kW	2.9 / 3.5	2.9 / 3.5	---	---	2.9 /3.5	2.9 / 3.5
Surface loading (Heater)								
230 V; 50 Hz		W/cm²	6.1	6.1	---	---	6.1	6.1
208 - 220 V; 3/PE~60 Hz		W/cm²	---	---	5.1	5.1	---	---
200 V; 3/PE~50/60 Hz		W/cm²	---	---	4.6	4.6	---	---
200 V; 50/60 Hz		W/cm²	4.6	4.6	---	---	4.6	4.6
400 V; 3/PE~50 Hz		W/cm²	---	---	7.1	7.1	---	---
208 - 220 V; 60 Hz		W/cm²	5.1	5.1	---	---	5.1	5.1
Protection			IP21C					
Pump type			Pressure pump					
Pump capacity (water 20 °C)	Discharge pressure max.	bar	2.9	2.9	2.9	2.9	2.9	2.9
	Flow rate max.	L/min	45	45	45	45	45	45
Connections for consumers			Thread M30 x 1.5 (DN 20)					
Overall dimensions B x L x H		mm	335 x 550 x 660	335 x 550 x 660	460 x 550 x 1285	460 x 550 x 1285	460 x 550 x 1285	460 x 550 x 1285
Weight		kg	87	90	180	180	150	150
Safety equipment		Class	III, FL suitable for flammable and non-flammable liquids					
Protection class			Protection class I according to DIN EN 61140; VDE 0140-1					
Class according to EMC-standards DIN EN 61326-1 (þ 1.1) Notice valid for Europe			B	B	A	A	A	A
for the USA and Canada			Class A (þ 1.1)					

Table 2 Process thermostats				XT 490 W	XT 550	XT 550 W
Operating temperature/ACC-range			°C	-90...220	-50...220	-50...220
Ambient temp. range			°C	5...40		
Humidity				maximum relative humidity 80 % for temperatures up to 31 °C, decreasing linearly to 50 % relative humidity at 40 °C		
Device distance to the surroundings						
front			cm	20	50	20
back			cm	20	50	20
right			cm	20	50	20
left			cm	6	50	6
Storage temperature range			°C	-20…44 the condenser must be completely emptied on a water-cooled device (þ 9.1.3)		
Setting resolution			°C	0.01		
Display resolution			°C	Master: 0.01 Command: 0.1 / 0.01 / 0.001		
Display accuracy				0.2 °C calibrated additively		
Filling volume, minimum			L	9.5	5.0	5.0
Additional filling volume in the expansion vessel			L	17.4	6.7	6.7
Refrigerant				R404A & R508A	R404A	R404A
Cooling refrigerating unit				Water	Air	Water
Cooling air temperature range without performance loss			°C	10...40	10…20	10...40
Cooling water connections				R¾“ A	---	R¾“ A
minimum diameter of the cooling water hose			mm	13	---	13
Cooling water temperature range / without performance loss			°C	10…30 / 10...15	---	10…30 / 10...15
Cooling water pressure			bar	3..10	---	3…10
Cooling water consumption temperature 15 °C, pressure 3bar ¯			L/h	1200	---	800
Cooling power at 20 °C ambient temperature; cooling water temperature 15 °C; cooling water pressure 3 bar; pump level 4 ①; if not different noted	Thermal transfer oil -	300 °C	KW	---	---	---
		200 °C	kW	4.4	5.0	5.4
		100 °C	kW	4.4	5.0	5.4
	Ethanol	20 °C	kW	4.4	5.0	5.4
	Ethanol	10 °C	kW	4.4	5.0	5.4
	Ethanol	0 °C	kW	4.4	4.6	5.4
	Ethanol	-10 °C	kW	4.4	3.4	4.3
	Ethanol	-20 °C	kW	4.4	2.2	2.9
	Ethanol	-30 °C	kW	4.4	1.25	1.6
	Ethanol	-40 °C	kW	4.0	0.6	0.8
	Ethanol	-50 °C	kW	3.3	0.15	0.15
	Ethanol	-60 °C	kW	2.3	---	---
	Ethanol	-70 °C	kW	1.35	---	---
	Ethanol	-80 °C	kW	0.7 Â	---	---
	Ethanol	-90 °C	kW	0.2 Â	---	---
Temperature stability at -10 °C, ethanol with external load			±K	0.1	0.05	0.1
			Liters	5	5	5

Table 2 Process thermostats		XT 490 W	XT 550	XT 550 W
Heater power / Power consumption				
230 V; 50 Hz	kW	---	---	---
208 - 220 V; 3/PE~60 Hz	kW	5.7 / 9.5	---	---
200 V; 3/PE~50/60 Hz	kW	5.3 / 8.6	---	---
200 V; 50/60 Hz	kW	---	---	---
400 V; 3/PE~50 Hz	kW	5.3 / 9.0	5.3 / 7.8	5.3 / 7.8
Surface loading (Heater) 230 V; 50 Hz	W/cm²	---	---	---
208 - 220 V; 3/PE~60 Hz	W/cm²	5.1	---	---
200 V; 3/PE~50/60 Hz	W/cm²	4.6	---	---
200 V; 50/60 Hz	W/cm²	---	---	---
400 V; 3/PE~50 Hz	W/cm²	4.6	4.6	4.6
Protection		IP21C		
Pump type		Pressure pump		
Pump capacity (water 20 °C) – Discharge pressure max.	bar	2.9	2.9	2.9
Pump capacity (water 20 °C) – Flow rate max.	L/min	45	45	45
Connections for consumers		Thread M30 x 1,5 A (DN 20)		
Overall dimensions B x L x H	mm	700 x 550 x 1600	460 x 550 x 1285	460 x 550 x 1285
Weight	kg	245	150	155
Safety equipment	Class	III, FL suitable for flammable and non-flammable liquids		
Protection class		Protection class I according to DIN EN 61140; VDE 0140-1		
Class according to EMC-standards DIN EN 61326-1 (þ 1.1) Notice valid for Europe		A	A	A
for the USA and Canada		A (þ 1.1)		

Table 3 Process thermostats			XT 750 (S)	XT 750 H(S)	XT 950 W(S)	XT 1590 W(S)	XT 1850 W(S)
Operating temp.- ACC range		°C	-50...220	-50...300	-50...220	-90…220	-50...220
Ambient temp. range		°C	5..40				
Humidity			maximum relative humidity 80 % for temperatures up to 31 °C, decreasing linearly to 50 % relative humidity at 40 °C				
Device distance to the surroundings							
front		cm	50	50	20	20	20
back		cm	50	50	20	20	20
right		cm	50	50	20	20	20
left		cm	50	50	6	6	6
Storage temperature range		°C	-20...44 the condenser must be completely emptied on a water-cooled device (þ 9.1.3)				
Setting resolution		°C	0.01				
Display resolution		°C	Master: 0.01 Command: 0.1 / 0.01 / 0.001				
Display accuracy			0.2 °C can be calibrated additively				
Filling volume, minimum		L	5.0	5.3	5.0	10.5	9.0
Additional filling volume in the expansion vessel		L	6.7	6.7	6.7	17.4	17.4
Refrigerant			R404A			R404A & R508A	R404A
Cooling refrigerating unit			Air		Water		
Cooling air temperature range without performance loss		°C	10…20		10...40		
Cooling water connections			---		R¾" A	R1" A	
minimum diameter of the cooling water hose		mm	---	---	13	19	19
Cooling water temperature range / without performance loss		°C	---	---	10…30 10...15	10…30 10...15	10…30 10...15
Cooling water pressure		bar	---	---	3…10	3…10	3…10
Cooling water consumption: temperature 15 °C, pressure 3bar ¯		L/h	---	---	1300	1500	1300
Cooling power at 20°C ambient temperature; cooling water temperature 15°C; cooling water pressure 3bar; pump level 4 ①; **if not different noted**	Thermal transfer oil - 300 °C	KW	---	5.50	---	---	---
	Thermal transfer oil - 200 °C	KW	7.00	7.00	9.00	15.00	18.50
	Thermal transfer oil - 100 °C	KW	7.00	7.00	9.00	15.00	18.50
	Ethanol 20 °C	KW	6.70	6.70	9.00	15.00	18.50
	Ethanol 10 °C	KW	6.10	6.10	7.50	13.00	12.50
	Ethanol 0 °C	KW	4.80	4.80	6.60	10.50	10.30
	Ethanol -10 °C	KW	3.40	3.40	4.60	9.20	7.70
	Ethanol -20 °C	KW	2.20	2.20	3.00	8.50	5.90
	Ethanol -30 °C	KW	1.25	1.25	1.70	8.50	3.80
	Ethanol -40 °C	KW	0.60 ®	0.60 ®	0.90 ®	7.00	2.20 ®
	Ethanol -50 °C	KW	0.30 ®	0.30 ®	0.35 ®	5.30	1.20 ®
	Ethanol -60 °C	KW	---	---	---	3.70	---
	Ethanol -70 °C	KW	---	---	---	1.80	---
	Ethanol -80 °C	KW	---	---	---	0.90 Â	---
	Ethanol -90 °C	KW	---	---	---	0.35 Â	---
Temperature stability at -10 °C, ethanol with external load		±K	0.05	0.05	0.10	0.30	0.30
		L	5	5	5	10	10

Table 3 Process thermostats		XT 750 (S)	XT 750 H(S)	XT 950 W(S)	XT 1590 W(S)	XT 1850 W(S)
Heater power / Power consumption 400 V; 3/PE~50 Hz	kW	LWP 520: 5.3 / 7.8	LWP 522: 5.3 / 7.8	LWP 521: 5.3 / 7.8	---	LWP 532: 10.6 / 13.8
	kW	LWP 552: 8.0 / 9.7	LWP 553: 8.0 / 9.7	LWP 554: 8.0 / 9.7	LWP 551: 8.0 / 13.8	LWP 533: 16.0 / 17.3
208 - 220 V; 3/PE~60 Hz	kW	5.7 / 7.6	5.7 / 7.6	5.7 / 7.6	---	---
200 V; 3/PE~50/60 Hz	kW	5.3 / 6.9	5.3 / 6.9	5.3 / 6.9	---	---
440 - 480 V; 3/PE~60 Hz	KW	---	---	---	7.0 / 16.6	14.0 / 20.8
400 V; 3/PE~50 Hz or	KW	---	---	---	5.3 / 16.6 or	10.6 / 20.8 or
440 - 480 V; 3/PE~60 Hz	KW	---	---	---	7.0 / 16.6	14.0 / 20.8
Surface loading (Heater)						
400 V; 3/PE~50 Hz	W/cm²	LWP 520: 4.6	LWP 522: 4.6	LWP 521: 4.6	---	LWP 532: 4.6
	W/cm²	LWP 552: 7.1	LWP 553: 7.1	LWP 554: 7.1	LWP 551: 7.1	LWP 533: 7.1
208 - 220 V; 3/PE~60 Hz	W/cm²	5.1	5.1	5.1	---	---
200 V; 3/PE~50/60 Hz	W/cm²	4.6	4.6	4.6	---	---
440 - 480 V; 3/PE~60 Hz	W/cm²	---	---	---	6.1	6.1
400 V; 3/PE~50 Hz or 440 - 480 V; 3/PE~60 Hz	W/cm²	---	---	---	4.6 or 6.1	4.6 or 6.1
Protection		IP21C				
Pump type		Pressure pump				
Pump capacity (water 20 °C) Discharge pressure maximum	bar	2.9	2.9	2.9	2.9	5.8
Pump capacity (water 20 °C) Flow rate max.	L/min	45	45	45	45	90
Connections for consumers		Thread M30 x 1.5 (DN 20)				Thread M38 x 1.5 (DN 25)
Overall dimensions B x L x H	mm	460 x 550 x 1285	460 x 550 x 1285	460 x 550 x 1285	700 x 550 x 1600	700 x 550 x 1600
Weight	kg	155	160	160	280	250
Safety equipment	Class	III, FL suitable for flammable and non-flammable liquids				
Protection class		Protection class I according to DIN EN 61140; VDE 0140-1				
Class according to EMC-standards DIN EN 61326-1 (þ 1.1) notice valid for Europe		A	A	A	A	A
notice valid for the USA and Canada		Class A (þ 1.1)				

EC Directives

The units are conformable to directives of the European Parliament and of the Council: 2004/108/EC electromagnetic compatibility and 2006/95/EC electrical equipment designed for use within certain voltage limits.

¬ The refrigerating powers are reduced by about 320 watts when Pump Level 8 is selected instead of Pump Level 4. The refrigerating powers are reduced by about 470 watts when Pump Level 8 is selected instead of Pump Level 2. With XT 1850 W(S) the refrigerating power is reduced by about 640 watts when Pump Level 8 is selected instead of Pump Level 4. With XT 1850 W(S) the refrigerating power is reduced by about 940 watts when Pump Level 8 is selected instead of Pump Level 2. .

- Devices filled with Kryo 55 up to a maximum temperature of 200 °C. Devices filled with Ultra 350 up to a maximum temperature of 300 °C.

® Pump Level 2.

Ã Water consumption for maximum refrigerating power

Ä With pump connection link

We reserve the right to make technical alterations!

Fuses of the mains connection data

	Mains connection	XT 150	XT 250 W	XT 280	XT 280 W	XT 350 W	XT 350 HW
Fuse:	230 V; 50 Hz	T16 A	T16 A	---	---	T16 A	T16 A
	208-220 V; 3/PE~60 Hz	---	---	T20 A	T20 A	---	---
	200 V; 3/PE~50/60 Hz	---	---	T20 A	T20 A	---	---
	200 V; 50/60 Hz	T16 A	T16 A	---	---	T16 A	T16 A
	400 V; 3/PE~50 Hz	---	---	T16 A	T16 A	---	---
	440-480 V; 3/PE~60 Hz	---	---	---	---	---	---
	400 V; 3/PE~50 Hz or 440-480 V; 3/PE~60 Hz	---	---	---	---	---	---
	208-220 V; 60 Hz	T16 A	T16 A	---	---	T16 A	T16 A

	Mains connection	XT 490 W	XT 550	XT 550 W
Fuse:	230 V; 50 Hz	---	---	---
	208-220 V; 3/PE~60 Hz	T25 A	T20 A	T20 A
	200 V; 3/PE~50/60 Hz	T25 A	T20 A	T20 A
	200 V; 50/60 Hz	---	---	---
	400 V; 3/PE~50 Hz	T16 A	T16 A	T16 A
	440-480 V; 3/PE~60 Hz	---	---	---
	400 V; 3/PE~50 Hz or 440-480 V; 3/PE~60 Hz	---	---	---
	208-220 V; 60 Hz	---	---	---

	Mains connection	XT 750	XT 750 S	XT 750 H	XT 750 HS	XT 950 W	XT 950 WS
Fuse:	230 V; 50 Hz	---	---	---	---	---	---
	208-220 V; 3/PE~60 Hz	T20 A	---	T20 A	---	T20 A	---
	200 V; 3/PE~50/60 Hz	T20 A	---	T20 A	---	T20 A	---
	200 V; 50/60 Hz	---	---	---	---	---	---
	400 V; 3/PE~50 Hz	T16 A	T16 A	T16 A	T16 A	T16 A	T16 A
	440-480 V; 3/PE~60 Hz	---	---	---	---	---	---
	400 V; 3/PE~50Hz or 440-480 V; 3/PE~60 Hz	---	---	---	---	---	---
	208-220 V; 60 Hz	---	---	---	---	---	---

	Mains connection	XT 1590 W	XT 1590 WS	XT 1850 W	XT 1850 WS
Fuse:	230 V; 50 Hz	---	---	---	---
	208-220 V; 3/PE~60 Hz	---	---	---	---
	200 V; 3/PE~50/60 Hz	---	---	---	---
	200 V; 50/60 Hz	---	---	---	---
	400 V; 3/PE~50 Hz	---	T20 A	T25 A	T25 A
	440-480 V; 3/PE~60 Hz	T20 A	---	T25 A	---
	400 V; 3/PE~50Hz or 440-480 V; 3/PE~60 Hz	T20 A	---	T25 A	---
	208-220 V; 60 Hz	---	---	---	---

Order Numbers and mains connection data of the Integral XT devices

	Mains connection data	XT 150	XT 250 W	XT 280	XT 280 W	XT 350 W	XT 350 HW
Order No.:	230 V; 50 Hz	LWP 112	LWP 113	---	---	LWP 117	LWP 119
	208-220 V; 3/PE~60 Hz	---	---	LWP 334	LWP 335	---	---
	200 V; 3/PE~50/60 Hz	---	---	LWP 434	LWP 435	---	---
	200 V; 50/60 Hz	LWP 512	LWP 513	---	---	LWP 517	LWP 519
	400 V; 3/PE~50 Hz	---	---	LWP 534	LWP 535	---	---
	440-480 V; 3/PE~60 Hz	---	---	---	---	---	---
	400 V; 3/PE~50 Hz or 440-480 V; 3/PE~60 Hz	---	---	---	---	---	---
	208-220 V; 60 Hz	LWP 812	LWP 813	---	---	LWP 817	LWP 819

	Mains connection data	XT 490 W	XT 550	XT 550 W
Order No.:	230 V; 50 Hz	---	---	---
	208-220 V; 3/PE~60 Hz	LWP 339	LWP 324	LWP 325
	200 V; 3/PE~50/60 Hz	LWP 439	LWP 424	LWP 425
	200 V; 50/60 Hz	---	---	---
	400 V; 3/PE~50 Hz	LWP 539	LWP 524	LWP 525
	440-480 V; 3/PE~60 Hz	---	---	---
	400 V; 3/PE~50 Hz or 440-480 V; 3/PE~60 Hz	---	---	---
	208-220 V; 60 Hz	---	---	---

	Mains connection data	XT 750	XT 750 S	XT 750 H	XT 750 HS	XT 950 W	XT 950 WS
Order No.:	230 V; 50 Hz	---	---	---	---	---	---
	208-220 V; 3/PE~60 Hz	LWP 320	---	LWP 322	---	LWP 321	---
	200 V; 3/PE~50/ 60 Hz	LWP 420	---	LWP 422	---	LWP 421	---
	200 V; 50/ 60 Hz	---	---	---	---	---	---
	400 V; 3/PE~50 Hz	LWP 520	LWP 552	LWP 522	LWP 553	LWP 521	LWP 554
	440-480 V; 3/PE~60 Hz	---	---	---	---	---	---
	400 V; 3/PE~50 Hz or 440-480 V; 3/PE~60 Hz	---	---	---	---	---	---
	208-220 V; 60 Hz	---	---	---	---	---	---

	Mains connection data	XT 1590 W	XT 1590 WS	XT 1850 W	XT 1850 WS
Order No.:	230 V; 50 Hz	---	---	---	---
	208-220 V; 3/PE~60 Hz	---	---	---	---
	200 V; 3/PE~50/ 60 Hz	---	---	---	---
	200 V; 50/ 60 Hz	---	---	---	---
	400 V; 3/PE~50 Hz	---	LWP 551	LWP 532	LWP 533
	440-480 V; 3/PE~60 Hz	LWP 642	---	LWP 632	---
	400 V; 3/PE~50 Hz or 440-480 V; 3/PE~60 Hz	LWP 742	---	LWP 732	---
	208-220 V; 60 Hz	---	---	---	---

We reserve the right to make technical alterations!

Table 4 High-temperature thermostats				XT 4 H	XT 4 HW	XT 8 H	XT 8 HW
Operating temperature/ACC-range			°C	80 - 320	30 - 320	80 - 320	30 - 320
Ambient temp. range			°C	5 - 40			
Humidity				maximum relative humidity 80 % for temperatures up to 31 °C, decreasing linearly to 50 % relative humidity at 40 °C			
Device distance to the surroundings							
front			cm	20	20	20	20
back			cm	20	20	20	20
right			cm	6	6	6	6
left			cm	6	6	6	6
Storage temperature range			°C	-20…44 the condenser must be completely emptied on a water-cooled device (þ 9.1.3)			
Setting resolution			°C	0.01			
Display resolution			°C	Master: 0.01 Command: 0.1 / 0.01 / 0.001			
Display accuracy				0.2 °C calibrated additively			
Filling volume, minimum			L	2.6	2.6	2.6	2.6
Additional filling volume in the expansion vessel			L	5.5	5.5	5.5	5.5
Cooling refrigerating unit				Air	Water	Air	Water
Cooling air temperature range without performance loss			°C	10 - 40	---	10 - 40	---
Cooling water connections device (outside) hose (inside)			inch mm		1/2“ id 19	---	1/2“ id 19
minimum diameter of the cooling water hose			mm	---	13	---	13
Cooling water temperature range / without performance loss			°C	---	10 - 30 / 10 - 15	---	10 - 30 / 10 - 15
Cooling water pressure			bar	---	3 - 10	---	3 - 10
Cooling water consumption temperature 15 °C, pressure 3bar ¯			L/h	---	600	---	600
Cooling power at 20 °C ambient temperature; cooling water temperature 15 °C; cooling water pressure 3 bar; pump level 4;	Ultra 350	300 °C	kW	---	16	---	16
	Ultra 350	250 °C	kW	---	16	---	16
	Ultra 350	200 °C	kW	---	16	---	16
	Kryo 55	200 °C	kW	---	16	---	16
	Kryo 55	150 °C	kW	---	15	---	15
	Kryo 55	100 °C	kW	---	9	---	9
	Kryo 55	50 °C	kW	---	2	---	2
Temperature stability at -10 °C, ethanol with external load			±K	0.05	0.1	0.05	0.1
			Liters	5	5	5	5
Heater power / Power consumption 230 V; 50 Hz			kW	3.5 / 3.7	3.5 / 3.7	---	---
208 - 220 V; 3/PE~60 Hz			kW	---	---	8.0 / 8.8	8.0 / 8.8
200 V; 3/PE~50/60 Hz			kW	---	---	8.0 / 8.7	8.0 / 8.7
200 V; 50/60 Hz			kW	2.65 / 3.2	2.65 / 3.2	---	---
400 V; 3/PE~50 Hz			kW	---	---	8.0 / 8.8	8.0 / 8.8
208 - 220 V; 60 Hz			kW	2.85 - 3.2 / 3.3 - 3.5	2.85 - 3.2 / 3.3 - 3.5	---	---

Table 4 High-temperature thermostats			XT 4 H	XT 4 HW	XT 8 H	XT 8 HW
Surface loading (Heater)						
230 V; 50 Hz		W/cm²	6.1	6.1	---	---
208 - 220 V; 3/PE~60 Hz		W/cm²	---	---	7.1	7.1
200 V; 3/PE~50/60 Hz		W/cm²	---	---	7.1	7.1
200 V; 50/60 Hz		W/cm²	4.6	4.6	---	---
400 V; 3/PE~50 Hz		W/cm²	---	---	7.1	7.1
208 - 220 V; 60 Hz			5.0 - 5.6	5.0 - 5.6	---	---
Protection			IP21C			
Pump type			Pressure pump			
Pump capacity (water 20 °C)	Discharge pressure max.	bar	2.9	2.9	2.9	2.9
	Flow rate max.	L/min	45	45	45	45
Connections for consumers			Thread M30 x 1,5 A (DN 20)			
Overall dimensions B x L x H		mm	335 x 550 x 660	335 x 550 x 660	335 x 550 x 660	335 x 550 x 660
Weight		kg	60	64	62	66
Sound pressure level		db(A)	51	51	51	51
Safety equipment		Class	III, FL suitable for flammable and non-flammable liquids			
Protection class			Protection class I according to DIN EN 61140; VDE 0140-1			
Class according to EMC-standards DIN EN 61326-1 (þ 1.1) Notice valid for Europe			A	A	A	A
for the USA and Canada			A (þ 1.1)			

Fuses of the mains connection data

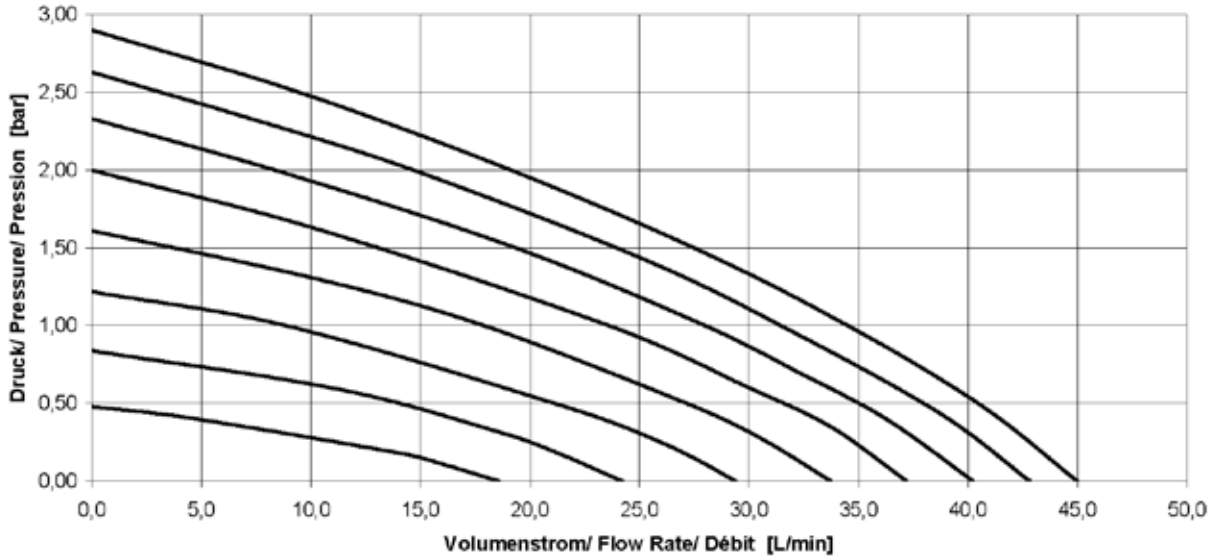
		XT 4 H	XT 4 HW	XT 8 H	XT 8 HW
Fuse:	230 V; 50 Hz	T16 A	T16 A	---	---
	208-220 V; 3/PE~60 Hz	---	---	T25 A	T25 A
	200 V; 50/60 Hz	T16 A	T16 A	---	---
	400 V; 3/PE~50 Hz	---	---	T16 A	T16 A
	200 V; 3/PE~50/60 Hz	---	---	T25 A	T25 A
	208-220 V; 60 Hz	T16 A	T16 A	---	---

Order Numbers and mains connection data

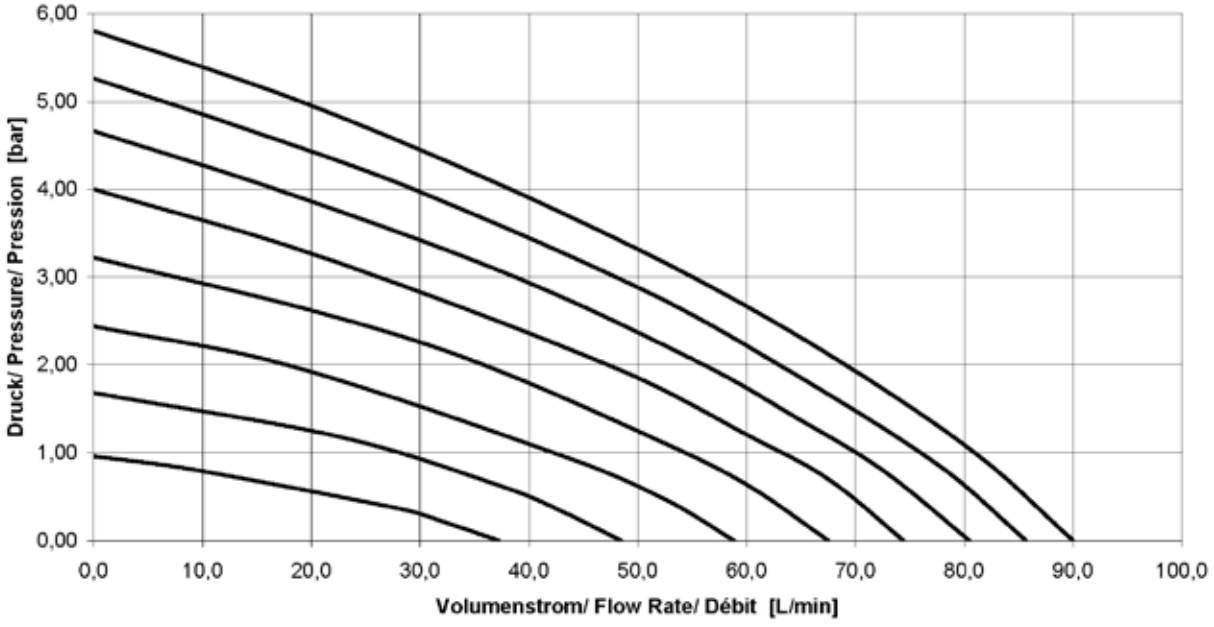
		XT 4 H	XT 4 HW	XT 8 H	XT 8 HW
LAUDA Catalogue number:	230 V; 50 Hz	LWP 147	LWP 148	---	---
	208-220 V; 3/PE~60 Hz	---	---	LWP 349	LWP 350
	200 V; 50/60 Hz	LWP 547	LWP 548	---	---
	400 V; 3/PE~50 Hz	---	---	LWP 549	LWP 550
	200 V; 3/PE~50/60 Hz	---	---	LWP 449	LWP 450
	208-220 V; 60 Hz	LWP 847	LWP 848	---	---

We reserve the right to make technical alterations!

Pump characteristics Integral XT
XT 150, XT 250 W, XT 280, XT 280 W, XT 350 W, XT 350 HW, XT 490 W, XT 550, XT 550 W, XT 750, XT 750 S, XT 750 H, XT 750 HS, XT 950 W, XT 950 WS, XT 1590 W and XT 1590 WS
Measured with water



Pump characteristics Integral XT 1850 W and XT 1850 WS
Measured with water



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An / To / A:
LAUDA Dr. R. Wobser • LAUDA Service Center • Fax: +49 (0) 9343 - 503-222

Von / From / De :

Firma / Company / Entreprise: _____

Straße / Street / Rue: _____

Ort / City / Ville: _____

Tel.: _____

Fax: _____

Betreiber / Responsible person / Personne responsable: _____

Hiermit bestätigen wir, daß nachfolgend aufgeführtes LAUDA-Gerät (Daten vom Typenschild):
We herewith confirm that the following LAUDA-equipment (see label):
Par la présente nous confirmons que l'appareil LAUDA (voir plaque signalétique):

Typ / Type / Type :	**Serien-Nr. / Serial no. / No. de série:**

mit folgendem Medium betrieben wurde
was used with the below mentioned media
a été utilisé avec le liquide suivant

_____

_____

_____

_____

Darüber hinaus bestätigen wir, daß das oben aufgeführte Gerät sorgfältig gereinigt wurde, die Anschlüsse verschlossen sind, und sich weder giftige, aggressive, radioaktive noch andere gefährliche Medien in dem Gerät befinden.

Additionally we confirm that the above mentioned equipment has been cleaned, that all connectors are closed and that there are no poisonous, aggressive, radioactive or other dangerous media inside the equipment.

D'autre part, nous confirmons que l'appareil mentionné ci-dessus a été nettoyé correctement, que les tubulures sont fermées et qu'il n'y a aucun produit toxique, agressif, radioactif ou autre produit nocif ou dangeureux dans la cuve.

Stempel **Seal / Cachet.**	**Datum** **Date / Date**	**Betreiber** **Responsible person / Personne responsable**

LAUDA DR. R. WOBSER GmbH & Co. KG
Pfarrstraße 41/43
D - 97922 Lauda-Königshofen
Internet: http://www.lauda.de
Tel: +49 (0)9343 / 503-0
Fax: +49 (0)9343 / 503-222
E-mail: info@lauda.de